Two tracks enter on the main floor of the laboratory under the

been done at night, when no current was passing.

THE

ELECTRICAL REVIEW.

VOL. LIX. JULY 20, 1906. No. 1,495.

ELECTRICAL REVIEW.

Vol. LIX.] CONTENTS: July 20, 1906. [No. 1,495.

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1906 Edition

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MUNICIPAL WIRING AND CONTRACTING.

FOR a number of years past the defeat of the municipal electric wiring and contracting proposals of the London County Council, and the various borough councils which that authority has been pleased to take under its wing in this connection, has been a regular event in the reports of Parliamentary proceedings. This year a different tale has to be recorded. Parliaments change, and Parliamentary policy for the most part changes with them. What was considered by one Government to be a trespass upon the rights of private enterprise, is thought by the members of another to be something quite different. We are all Socialists and municipal traders now, if we may be considered individually responsible for the legislative tendencies of the last six months. The Electrical Contractors' Association has torn its opposition hair in vain this time, for even the Lords did not assemble in sufficient force, or, perhaps we ought to say, in proper mood, to do justice to a principle which they defended and protected on a former occasion.

If there be any truth in what "An Engineering Correspondent" says in the *Times*, the Electrical Contractors' Association is to some extent responsible for the failure, inasmuch as it started its opposition proceedings too late, and was refused a *locus standi* in consequence. What might have been a good case was "mismanaged from the outset," we are told. Really, except for the principle involved, if the contractors' own organisation is not sufficiently in earnest we do not know whether we or anybody else should be concerned. The cause is theirs—they will be the losers—and if it be not worth fighting properly it may not be worth fighting at all. They will have themselves to thank for any large extension of municipal wiring which may follow in the Metropolitan area. Some have wondered whether the contractors really care—is it surprising?

There was some good discussion in the Lords on Monday when the Earl of Wemyss moved to omit Clauses 28, 29 and 30 of the L.C.C. (General Powers) Bill which are the offensive clauses which empower the Council to sell electric fittings and do wiring and other installation work, but the amendments were negatived, and the contractors' interests are not safeguarded. It was strongly urged that it was not in the interests of the nation that the private trader should be driven out of the market by municipal or State trading, and it was shown that if and when the electric fittings department is operated at a loss, the electrical contractor whose business is injured by the competition has, as a ratepayer, to bear his share of such loss.

The Earl of Camperdown is professedly opposed to municipal trading, and yet in the same breath in which he makes that profession, he argues for the clauses because they merely give the distributors of power and light the liberty to supply the fittings by which that power or light should be used,

and because it might be more convenient for the consumer to get his fittings and hire his motors where he buys his light and energy. This is the sort of argument which leads up to the idea of municipalisation of all things because they have some connection or other with something already municipalised. We are in entire agreement with Lord Clinton when he says that such convenience as may be supposed to result to the consumer does not outweigh the primary objections to municipal trading, and also when he adds that it is unreasonable that the money of ratepayers should be used in competition with retail traders.

It would be interesting to know what was the evidence that was given in Committee to lead Lord Leith of Fyvie to consider the clauses to be advantageous to the ratepayers. What about the losses incurred in the conduct of such departments? What about electrical tradesmen who are ratepayers? The Duke of Northumberland, who was chairman of the Committee which last year threw out the proposals, consistently followed on the same line this year, and opposed the clauses on the ground of unfair competition. And electrical men ought to be grateful to the noble duke for this as well as for his protest against the system of legislation which allows a body like the L.C.C. to renew proposals year after year, "draining the pockets of their opponents to such an extent that they gave up opposition, and a Committee was induced to accept the proposal." How many thousand pounds have been similarly wasted in the promotion of London electric power supply schemes during the last few years?

The Earl of Granard made a quite ignoble showing when, as spokesman on behalf of the Board of Trade, he said that that body "saw no reason for refusing a power already enjoyed by *gas companies*." There is all the difference in the world between what should be allowed to a company and what should be conceded to the L.C.C. We doubt whether the Electrical Contractors' Association would lift a finger to oppose wiring and installation powers being granted to a supply company. The crux of their objection is that *public* money (not gas or electricity companies' money) is employed in enabling an unfair competition—unfair because municipally privileged—to be established against them.

So far as companies are concerned, if we may judge from the recent experience of some of those doing business in the provinces, the combination of electricity supply and contracting has not been found to be altogether desirable. Those we have in mind have divorced the two departments after some years' working, preferring to have their hands free exclusively to foster the electricity generating and selling business. Of course we do not doubt that there may be other considerations involved, such as convenience in working.

Speeds and Curves.

Mr. Rous-Marten, when penning those collocations of flowing adjectives with which he builds up articles on locomotive running in the *Engineer*, would do well, in our opinion, to confine his industry to such wordy descriptions, and not to attempt to discuss engineering matters of real importance. We believe that the curve at Salisbury Station at which the American boat express left the line, is a curve of such sharpness and so low a superelevation that the South-Western Railway authorities limit the speed round it to 30 miles per hour as a maximum. Yet, in the *Engineer* of the 6th inst., Mr. Rous-Marten writes as though this curve were regularly passed over at 70 miles per hour.

It is extremely improbable that such a thing can be substantiated, and if it were true, one might well ask what the officials were doing to permit such excessive speeds in face of their own regulations. Mr. Rous-Marten talks about hysterical rant, and has a great deal to say about the steadying effect of speed. We do not know if he writes this out of friendly feelings to the railways over whose lines he gets so much travelling, or whether he hints at the accident being caused by breakage of some part of machinery or rail with a view to reassuring the public. If he does, he certainly has not succeeded. The travelling public will be far more assured if they realise that the engine left the metals because it was bound to do so at the speed, than if they are left in doubt. The very fact that the accident happened is an assurance that it would not have occurred at a proper speed, although on a straight line any reasonable speed is safe. The South-Western Co. have very properly admitted their liability, and the evidence of the guard at the inquest was that the speed was excessive, over 50 miles per hour—other evidence showed it to be nearly 70—and he put on his brake to awaken the engine driver to a sense of the high speed. Moreover the company's engineer and the superintendent both frankly attributed the disaster to "excessive speed" at a spot where it should never have exceeded 30 miles an hour, and the jury could arrive at no other verdict.

Mr. Rous-Marten talks glibly of regular running at very much higher speeds, just as though the first law of motion had no existence, and a curve in good order could be taken as safely as a tangent.

The accident might, of course, have been caused by a breakage, although we now know that it was not, but why at the same time, having to admit that the speed was high, should one endeavour to say there is no danger round a curve? No wheel flange in the world will make a curve safe at an improper speed, and the companies' own regulation must surely appear pedantic folly to the *Engineer's* correspondent.

Tramway Systems and the Law of Nuisance.

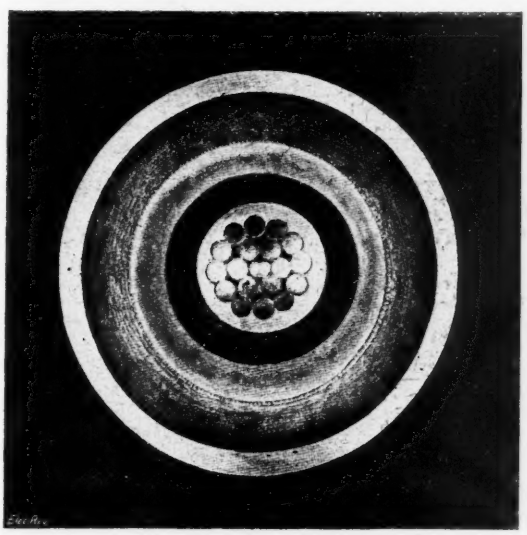
The *impasse* which has occurred owing to the fact that the London County Council generating station at Greenwich is likely to interfere with the Observatory, raises a legal question of a very interesting character. Would it be competent for the Astronomer Royal to bring suit to restrain the County Council from committing a nuisance? It is clear law that if a neighbour carries on a noisy trade, or sets the floor of any house vibrating so that the plaintiff's nervous system is upset, he may seek an injunction in the Courts. But does this doctrine apply to those slight vibrations which, though too small to interfere with bodily comfort, are nevertheless fatal to scientific investigation? Up to a few years ago, the English lawyer would have had little hesitation in answering this question in the affirmative, but a case of comparatively recent date has somewhat distorted the current of opinion.

An electric telegraph company at the Cape found that their message-sending apparatus was seriously affected by powerful currents of electricity which were used by an electric tramway company close by. They consequently brought an action against the tramway company. The Judicial Committee of the Privy Council (who were called upon to pronounce a final decision on the case) said that it was true that no man had a right to allow electricity to escape from his own land and do injury to other people; but that this was only half the question. It remained to be seen whether the injury postulated was present. "The true comparison is with things used in the ordinary enjoyment of property, and this cable differs from such things in its peculiar liability to be affected by even minute currents of electricity. . . A man cannot increase the liabilities of his neighbours by applying his own property to special uses, whether for business or pleasure." It may be, of course, that the Courts would confine the principle of the decision above referred to, to cases in which a man lets something escape from his land. But a distinction between electrical vibrations in the ether, and mechanical vibrations, might be regarded as almost too fine. It will be interesting to see whether the Courts will be asked to intervene in the present dispute.

AN EXHIBIT OF HIGH-TENSION CABLES AT THE MILAN EXHIBITION.

The rapid progress which has taken place of recent years in Northern Italy in electrical engineering is most remarkably apparent in the application of electric power for lighting, traction and factory driving. Since the high cost of coal in Northern Italy prohibits the economical working of steam power stations, while water power is abundant, there has resulted a vast net-work of high-tension transmission lines, running from the numerous hydraulic power stations to the factories and cities in the plains of Northern Italy.

In some cases it is necessary for these lines to pass underground, and a great amount of attention has, therefore, been given to the development of a high-tension cable.



Section of Pirelli 100,000-volt Cable.

In this field it is impossible to omit careful consideration to the high-tension cable exhibited by the well-known Pirelli Co., of Milan, whose transmission cables have recently been supplied to the largest power stations in the world, viz., those of the Ontario Power Development Co., of Niagara.

Those of our readers who attended the St. Louis Convention, in America, will recall the interesting and important paper read before the electrical engineering section by Mr. Jona, chief engineer of this firm, and now the president of the Italian Electro-technical Association.

In this paper and in other published works the theory of the grading of cables with respect to the specific inductive capacity of the various wrappings, an idea conceived first by Mr. O'Gorman, of London, was thoroughly developed, and has now been carried so far that it is easy to form an accurate idea of the stresses taking place in high-tension cables.

At the St. Louis Exhibition a cable designed for a working pressure of 50,000 volts was exhibited, and Messrs. Pirelli now show at the Milan Exhibition a cable for 100,000 volts normal working pressure, on which tests already undertaken lead to the expectation that a pressure in the neighbourhood of 200,000 volts may be withstood; a section of this cable is to be tested with a special 300,000-volt transformer, which is now in course of construction, at the time of the Milan Exhibition Engineering Congress to be held in September next.

This cable has already been tested to 150,000 volts without any apparent injury, but the breakdown of the transformer prevented the voltage being raised higher. In this cable all the radically important points have been considered carefully. The stranded conductor is covered with a lead sheath, thus producing a smooth surface of much greater radius, by which small device alone the static strain is considered to be reduced more than 10 per cent. The insulation is then wrapped in layers arranged in order of decreasing specific inductive capacity, from the centre to the circumference, and by careful choice of materials an extremely uniform potential gradient is obtained.

Reference to the figure shows a section of this cable, which should be of great interest when it is considered that it is designed for the highest voltage ever yet employed. The conductor consists of 19 wire strands, each wire being 3·3 mm. in diameter, and the total section of copper is 162 sq. mm. The strand is covered with a lead tube, of 18 mm. outer diameter. The first layer of insulation consists of rubber 2·5 mm. thick, having a S.I.C. of 6·1; this is followed by second and third layers of rubber of 2·3 mm. and 4·5 mm. thickness, and having S.I.C.'s of 4·7 and 4·2 respectively. Over this rubber is a layer of impregnated paper 5·2 mm. thick, with a S.I.C. of 4. The cable is then hemp coated and lead covered, the total thickness of insulation being 14·5 mm. The manufacturers state that no radical change has been made from the cable shown at St. Louis, the great difference being in extreme care in manufacture and in the selection of materials for the different wrappings. The diameter over the outside of the lead is only $2\frac{5}{16}$ in.

This firm also exhibits a large variety of cables for all capacities and voltages, with special designs for the army and navy, for telephone and telegraph work, and a large collection of rubber appliances for mechanical purposes and rubber tires for automobiles; the last is a new department of the company which has been very successful.

The factory of this firm has recently been considerably increased, and now covers a ground area of 30,000 sq. m., while more than 3,200 men are employed in the Milan factory alone. A visit to the works of this firm is of interest for many reasons, but especially as a striking example of the use of by-products and of all varieties of rubber, gutta-percha, and insulation materials, which are adapted to an enormous number of purposes; undoubtedly this must lead to great economy in factory practice.

The Internal Cleaning of Electrical Machinery.—The attention required by electrical machines, whether stationary or with moving parts, is little, but that little needs to be carefully bestowed to be effective. Next to the lubrication of rubbing surfaces, which is generally of the simplest nature possible, cleaning is the most important consideration, particularly with regard to internal regions, where heat is most likely to affect any matter present.

A large proportion of electrical machinery, generators, motors, rheostats, &c., is of such construction that the interior is not accessible for the removal of the ubiquitous matter-out-of-place by the direct application of the usual agents, namely, rags and waste, which suit the purpose so far as the exterior is concerned. In order to meet the necessities of the case air is pressed, or rather compressed, into service, with the result that cleaning can be thoroughly accomplished by a jet of air under a pressure of some 20 or more lb. per sq. in. above the atmospheric pressure.

When the amount of cleaning to be done is small, as in the case of an installation of one or two motors of some 10 or 20 H.P., a pair of hand bellows energetically applied once or twice a week will prove amply sufficient for the purpose; but where the machines are many or of larger size a more powerful and sustained source of air-blast must be utilised to obtain the utmost expedition. As an example of the latter case may be taken any electric generating station with more than four or five generators, where it is desired so to arrange the duties of a limited staff that they can do multifarious tasks as readily as possible.

It is found that if an air compressor is installed with a suitable system of piping the machinery can be kept in a more satisfactory state with one quarter the time, and less than that proportion of human energy that will be required if a pair of bellows is applied to each machine with the necessary intervals of rest between.

A suitable equipment of the kind for a central station consists of an air compressor driven by a motor or engine, of about ½ H.P., fixed in the machinery room with a 1-in. main air pipe under the floor in connection with a cylindrical reservoir of about 3 cb. ft. capacity. From the main pipe a ¾-in. branch with a valve, just above floor level, is taken up to each generator with a pipe terminal to which may be attached a flexible hose of the length necessary to reach all parts of the machine. The hose should be of the kind protected by wire, and may suitably terminate at the "business" end in 6 in. of ⅜ in. brass tube hammered flat at the point to make a slit-like orifice 1 in. × $\frac{1}{16}$ in., this shape enabling it to be presented more effectually than a circular nozzle between armature windings.

To take a different case, where the machinery to be operated on consists of many motors in different parts of a building, as in a tramway car-shed, a portable electrically-driven air compressor, with flexible leads and pipe, is a more useful apparatus.

D

RAYMOND PHILLIPS' SYSTEM OF AUTOMATIC TRAIN CONTROL.

IN this system, a successful demonstration of which was given on Tuesday, July 10th, on the North Stafford Railway, at Stoke-on-Trent, the position of the outdoor signals is repeated in the cab of the locomotive, so that a driver may at all times know definitely the state of the signals before him. In "Raymond Phillips' System of Automatic Train Control," pneumatically operated semaphores are fitted in the cab of an engine so as to present a clear view to the driver. These semaphores faithfully repeat the condition of the line signals, and, moreover, should a driver from any cause disregard a danger signal, the arrangement is such that the train is automatically pulled up independently of the driver's own operations, and an audible signal is given by a whistle, horn, or siren; in addition to this the signalman is immediately informed of such irregularity by means of the repeater in the signal box, and a bell rings at the same time. The risk of breakages and consequent failure is a point which has been well considered in the Phillips system, and by ingenious, but simple, arrangements, the breakage of any portion of the system does not entail danger, as such an event is notified to the driver and signalman and causes the line to be immediately blocked where such breakage occurred. Any breakage in the system can be readily rectified, all parts being interchangeable. It may be mentioned, however, that although a locomotive has been fitted with the Phillips system for nearly two years it has not been necessary to replace a striking lever, all the levers being in perfect order at the present time.

The accompanying figures show the action of the apparatus.

The vacuum reservoir is normally in connection with the semaphore gauges through the valves A and B, fig. 1, so that the semaphore arms are kept depressed. When the striking lever (E) is deflected by striking the tripper mechanism fitted in the permanent way, the weighted end of lever 3 drops and locks the striking lever in the deflected position, the piston valve A falls, cutting off the vacuum at pipe 18 and permitting air to enter the gauge pipe 19, the distant semaphore arm is consequently raised to danger and at the same time the other end of the valve lever 3 raises piston 6 so that air enters the train pipe through the siren fixed near the indicators.

To restore the signal the lever of the three-way cock is turned to the right so as to connect the reservoir through pipes 15 and 13 with the bottom of cylinder 8, the piston is pushed down and lever 3 restored so that the striking lever E resumes its vertical position; the piston 17 of valve A is also restored and the vacuum reservoir is again connected with the semaphore gauge, the arm of which is thereby depressed to the "clear" position.

The "home" valve lever is similarly actuated, but when it falls downwards. This lever is heavily weighted to secure its restoration to this position, so that the bottoms of the cylinders 8 and 9 are freely exposed to the atmosphere through pipes 13 and 14 to ensure that the pistons 6 and 7 shall rise freely when the controlling levers are actuated. The drawing shows the normal position of the levers with respect to the cylinders. It will be seen that in the event of the connecting links or pins breaking, the pistons would drop to the bottom of the cylinders and expose the train pipe to the air. The striking levers E and F are each mounted on separate

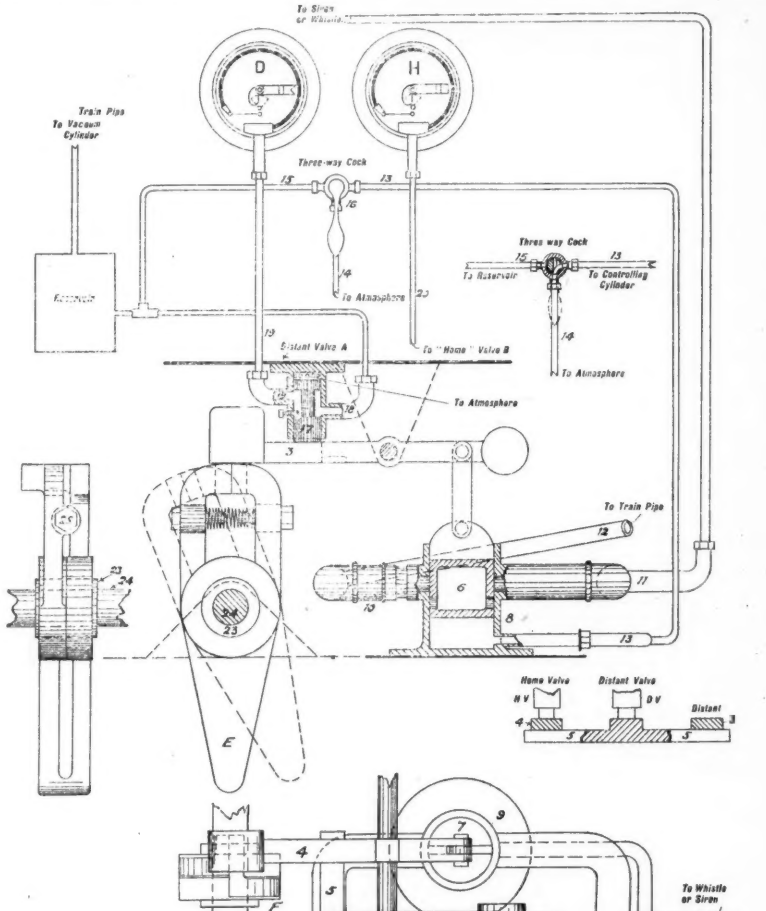


FIG. 1.

bushes to secure free movement; the drawing shows the fitting of lever E, the bush 23, and common axle 24. The spring inserted in the jaws of each striking lever is held in position by the bolts marked 25, and in the event of the striking end of the lever

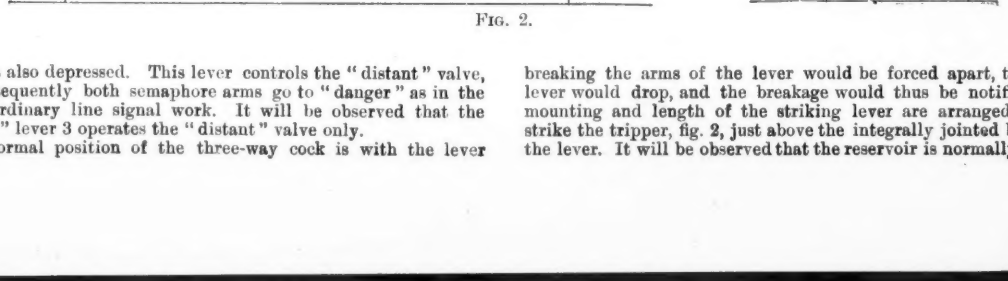


FIG. 2.

lever 5 is also depressed. This lever controls the "distant" valve, and consequently both semaphore arms go to "danger" as in the case of ordinary line signal work. It will be observed that the "distant" lever 3 operates the "distant" valve only.

The normal position of the three-way cock is with the lever breaking the arms of the lever would be forced apart, the valve lever would drop, and the breakage would thus be notified. The mounting and length of the striking lever are arranged so as to strike the tripper, fig. 2, just above the integrally jointed blades of the lever. It will be observed that the reservoir is normally only in

connection with the valves A and B; these are so fitted that there is little likelihood of a leakage into the vacuum. The object in providing a separate reservoir for working the mechanism is to render it independent of the brake reservoir or train pipe, so that when the latter is operated either through the communication cord or otherwise the semaphore gauges are unaffected.

The system has, we understand, been approved by the Board of Trade.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Gas and Electricity.

In your issue of 13th inst., I notice that there appears an article by Mr. A. J. Abraham, Cambuslang, headed "Gas and Electricity." As this is a subject of special importance to me, I fastened on to it somewhat greedily, hoping to gain fresh facts to confute our ancient enemy the "gas man." Judge of my surprise when I found that the "bête noir" of our estimable friend Mr. Abraham was the much abused "wiring contractor"; and note, in passing, that he does not even deign to qualify the contractor by the addition of electrical to his title.

I have to thank Mr. Abraham for that, because it has struck me that a lot of "wiring contractors" (so-called) were neither electricians nor electrical engineers; he evidently confirms my impressions on that point. Perhaps, however, I misunderstand Mr. Abraham, and his meaning is that no contractor is worthy of being classed as a member of the electrical profession, and that the honour should be alone conferred on resident and central station engineers and such like. I have found a good deal of that spirit abroad in the land, and fear that even our Institution is somewhat tainted with the plague.

That electrical contractors are *entirely* to blame, or even *mostly* to blame, for the state of matters which Mr. Abraham complains of, I am inclined to deny. Witness the vast number of Nernst lamps which electrical contractors installed in Glasgow and neighbourhood—and are, to a certain extent, still installing—and then ask why there has been trouble with burners and renewals, and he will find that the voltage of supply is so variable that no burners can have anything like a reasonable life. Why, for example, should it be necessary to supply 250-volt burners and 20-volt resistances on a nominal 250-volt supply; is it in the least likely that one can obtain the most efficient light by such a combination? And who but the central station engineer is responsible for this variation of voltage? In one burgh not 100 miles from Glasgow, I have seen the voltage falling from 255 to 225, and then rising to 270 within 10 minutes; is that what it ought to be?

Besides, how long are consumers to be puzzled and harassed by a maximum demand system of charging? I know it is a most honest and fair system, but that does not alter the fact that is a perpetual worry to the non-technical consumer; and what is worse still, is this, that the consumer in reckoning out what his proposed lighting will cost him per hour, takes, not the average price per unit over the whole year, but the maximum price, consequently showing to the disadvantage of electricity.

Mr. Abraham deals with the fact that the contractor who quotes for economical lighting will be "cut" out by the man who does not, and he makes the suggestion that the "former contractor" should give "two quotations." Well, if Mr. Abraham were compelled by a prospective customer to make out not *two* but *half a dozen* quotations in an endeavour to bring down the first cost of an installation from £12 10s. to £10, he would be in a position in which he would talk less glibly of giving "TWO (capitals, if you please) quotations."

He informs us that shops are being wired in Glasgow for 8s. per light; he really has been too generous in that figure, as I am informed of such work being done at 6s. 9d.; and really you can't expect a flame arc lamp at that money, can you?

But if corporations, parish councils, and such like public bodies would lead the way in refusing to accept prices so ridiculously low that a cursory glance at the figures would prove them inaccurate, then we might, perhaps, hope—in time—to get the ordinary man to look not so much to first cost as to running cost. That electrical contracting is in a bad way is undoubted, and it will continue in a bad way so long as public bodies do as they are doing. If a Corporation gives Tom Jones, the plumber, the electric lighting of one of its public buildings, because the said Tom Jones *guessed* it out at 11s. 9d. per light, while the electrical firms known and recognised as doing good work *estimated* it out at 18s. 6d. to 21s. 6d., what else can be expected but a general degradation and lowering both of prices and of the quality of work?

Let Mr. Abraham and others who are placed in positions like him do all they can to encourage such contractors as they know to be anxious to give good, economical and up-to-date work, and circularise intending consumers stating that they will gratuitously advise them regarding the most economical methods of lighting, and we should soon cease to hear this everlasting wail about gas.

John D. Mackenzie.

Glasgow, *July 14th*, 1906.

The Single-Phase Induction Motor.

I admit that I have had some difficulty in following the opening paragraph of Mr. Pensabene-Perez's last letter.

To begin with, it would be interesting to hear which are the results that can hardly be accepted, and to which my method of demonstration is supposed to lead. I readily agree that in an ideal motor we have at synchronism two equal fluxes (M and M_1) at 90° to each other in phase and space, for I have upheld this very view from the very first, and I have also explained over and over again that the flux M_1 is due to a current flowing in the rotor along the motor field axis and due to an E.M.F. produced by rotation of the rotor conductors in the transformer field. According to my theory, *there is* a current in the rotor and along the motor field axis even at synchronism or at no-load. That such a current really exists is, I presume, universally recognised, and I entirely fail to see what point Mr. Pensabene-Perez is trying to make against me in his opening remarks.

Later on, he confesses that he cannot see the reason for my *contempt* for the rotating field theory. If memory serves, I simply said that the rotating field theory was an extremely clever substitution of a sequence of imaginary events for the real ones, and pointed out several reasons why it was inadequate to fully explain the operation of a single-phase motor. One of the reasons why I object to this theory as applied to these motors has now again been brought to the fore by Mr. Pensabene-Perez himself, in the first paragraph of his last letter. He says that at synchronism, when M and M_1 are equal, a rotary field is set up which rotates at the same speed as the rotor, and that consequently there can be no current in the rotor. Such is truly the teaching of the rotating field theory, and one may indeed ask with Mr. Pensabene-Perez, "then how has the motor flux been produced?" The answer I have given more than once.

Dealing now with the next seven paragraphs of the letter, I quite agree with Mr. Pensabene-Perez and the vast literature to which he refers, that the two E.M.F.'s of which he speaks will be set up in a polyphase wound rotor revolving in a flux M. These E.M.F.'s will both be of the same frequency as the supply, and when the motor windings are short-circuited will tend to produce currents in these windings. M.M.F.'s are thus set up, and we are agreed that the one in the motor field axis remains undisturbed, becoming equal to the primary M.M.F. when synchronism is reached. The M.M.F. along the armature axis is, however, *nil*, as I have shown in my last letter. The reason why Mr. Pensabene-Perez arrives at a different conclusion is that he neglects the effect of the flux M_1 due to the M.M.F. in the motor field axis. This flux increases with the speed, at synchronism it equals M, and also produces E.M.F.'s in the rotor windings which surely ought to be considered.

I have demonstrated my contention in such an elementary manner that any mistake must be very easy to detect and to correct. I suggest that Mr. Pensabene-Perez should show where my argument is at fault. He might do this, for instance, in connection with fig. 12, for in that particular case i_0, the primary magnetising current, reaches a positive

maximum, and this case would afford him a good opportunity to show, if he can do so, that i_0 ought at that time to be twice that amount.

As the matter stands now the evidence is absolutely against Mr. Pensabene-Perez for eight positions of the rotor, but if a proposition does not hold good for eight positions, it is more than likely that it will not hold good for any of the others.

With regard to the diagram fig. 2 on page 6, it is for the present sufficient to say that if it shows the power factor of a single-phase motor to be a maximum when that motor is at rest, then it is certainly not correct. A simple test proves the contrary.

Val. A. Fynn.

London, S.E., *July 10th*, 1906.

Inaccurate Electricity Meters.

We have closely followed up the correspondence about inaccurate electricity meters which took place in the last issues of your paper, and we note that the chief trouble is to come to an agreement between the consumer and the Electric Supply Co. when the consumer doubts the correct registration of the meter installed.

To overcome this difficulty, we have constructed a portable testing meter which can be certified by the Board of Trade: and can serve as an arbitrator between the consumer and the supply company.

If the consumer disputes the lighting bill, we think it best to bring such a portable testing meter to his premises and check his own meter. If there is any difference between the supply type meter and the testing meter, the bill can be adjusted in accordance with the constant found.

per **Aron Electricity Meter, Ltd.**
E. Dormann.

London, *July 13th*, 1906.

The statement contained in my ubiquitous friend's letter in your issue of June 29th is substantially correct, but the practice of having meters certified is not general.

Mr. David Smith, of Tunbridge Wells, thinks it is a risky thing to remove a meter which is known to be inaccurate. That is as it may be, but the remark does not apply.

The point is this: When a meter is brought in in the ordinary course—either because it has been in use two or three years, according to the period of changing, or in consequence of additions to the installation necessitating a larger meter—and is then found to be outside the limits prescribed by the Board of Trade, what may be done? It is 10 per cent. fast; has 10 per cent. to be allowed off the account for the whole of the time the meter has been in? for half the time? for three months? off unpaid accounts? or not at all? It is 10 per cent. slow; has 10 per cent. to be added to the account, and if so, for how long?

In my opinion, if there is no point at which the consumption shows a marked increase or diminution, half the period during which the meter has been in use is fair, as the inaccuracy will probably grow slowly, according to a straight line law.

"Tester," "Meter Superintendent," and "Only One Case" have evidently experienced the usual meter troubles, but I am anxious to know the legal powers of the supply authority. I am glad to note that your legal contributor is dealing with the matter, and trust he will consider the question of the piece of dirt on the disk, which appears to have been so minute as to have escaped the notice of your correspondents.

It is sometimes advisable to make an allowance for the sake of peace and quietness. Perhaps Mr. Smith will not agree with this, but if the matter goes into the County Court, the probability is that the judge, having regard to equity rather than law, will split the difference, so why not do it outside, and save the expense? I do not think that can be called corruption, or that the auditors would cavil at it. It is ordinary business diplomacy.

Meters.

[An article on this subject by our Legal Contributor appears on page 117 of this issue.—Eds. E.R.]

Rail Corrugation.

As a member of the Tramway and Light Railways Association, I have recently received in the *Official Circular* for June, a valuable contribution to the vexed question of rail corrugation. This subject is also referred to by Mr. England in his Presidential Address delivered at the Summer Conference of the Association of Tramway and Light Railway officials.

Mr. England is convinced that the rolling and composition of the rail is the cause of the trouble, while Mr. H. Mozley hopes to prove that distorted American trucks are responsible.

That variation in the hardness and composition of rails exists is indisputable; and, to a certain minor extent this is, of course, a contributory cause. With American trucks, and copies of American trucks made in Europe, I am too well acquainted to deny that they are what they are—cheap—and this applies to 90 per cent. of the trucks running in this country. Nevertheless, I cannot again say that a skewed axle may cause rail corrugation. You could hardly produce the corrugation that way if you wanted to do so. I think if Mr. Mozley were to watch the behaviour of the axle with my radial truck suspension (which, I am sure, is the "last word" in truck running), it would probably change his views on the subject, as much as it has my own.

The main possible cause of rail corrugation, it occurs to me, and I have not seen it put forward yet, is that the road bed vibrates, and vibrates with a characteristic periodicity.

The average tramway truck is something very like a huge armoured concrete slab (or tympan), which will deflect and vibrate under the passing of a 10-ton car. Service conditions will tend to repeat the approach and passage of cars over the guilty rail at a certain speed more frequently than at other speeds.

The vibrations of the road crust will be frequently set up just when the car strikes a certain point, and so occurs a coincident contact, or variation of contact pressure, between rail and wheel.

The remedy would be to grout with cement under the concrete, or to isolate sections of the concrete so breaking the transverse continuity of the bed.

J. S. Warner.

Forest Gate, *July 16th*, 1906.

Manufacturers Selling Direct to Customers.

As one of those E. C.'s who have felt the pinch referred to by Mr. M. McBratney on more than one occasion, we have in mind glaring instances of this unfair and underhanded "system" of poaching. Quite recently one of our customers was approached in this way, but he had a conscience, and having secured quotations in writing, was good enough to hand them on to us, when we found the terms were practically the same to the customer as to ourselves. As members of the E. C. A., we suggest a "black list" to be circulated to members only, and thus assist in abolishing this increasing evil by unscrupulous manufacturers gaining the ascendancy over firms who wish to act honourably toward their clients. Personally, we are doing our share to mete out due reward to the offenders.

One of the Pinched.

July 17th, 1906.

Speed-Reducing Gear.

Having seen some advertisements of the speed-reducing gear made by Humpage, Jacques & Pederson, Ltd., of Aston Gate, Bristol, I am writing to ask if any of your readers have any practical experience of these gears. Information is particularly required on the following points:—

1. Reliability of operation under prolonged and severe service.
2. Efficiency.
3. Accessibility in case of any adjustments being required.
4. Its adaptability to electric motors, and whether it is possible to run this gear supported from the floor, wall or ceiling.

A. Adair.

Rugby, *July 14th*, 1906.

Tramway Feeder Cables.

I should be greatly obliged if you could, through the medium of your valuable paper, give me any information as to which of the following methods is most *common* in coupling up section pillars to feeder cables on tramways :—

(*a*) Boxes on each feeder in series (cable cut at each half mile, and the ends led into box).

(*b*) Boxes on each feeder in parallel (cable run to full distance of its feeding point and tappings taken off feeder at intermediate boxes).

The accompanying sketch will illustrate what is meant in *a* and *b*.

Assistant.

[The effect in either case is the same ; but it is far better to loop the feeder into the boxes than to make tee-joints, as shown in sketch *b*, and we doubt whether the latter method is ever employed.—Eds. E.R.]

PARLIAMENTARY.

Lancashire Electric Power Bill.

Lord Clifford of Chudleigh's Select Committee of the House Lords had this Bill under consideration last week.

Mr. Ram, K.C., who opened the case for the promoters on Thursday, explained that the Lancashire Electric Power Co. was incorporated by an Act of 1900, with a capital of £3,000,000, and one-third borrowing powers. The area of supply was a very important one. It was the whole of Lancashire south of the River Ribble, with the exception of certain large towns, including Manchester, Salford and Liverpool. The powers were to be exercised only for supplying any general supply district—that was to say, a district in which any company was authorised by order to give a general supply, and, secondly, any local authority or company authorised by Act or order to give a supply. Counsel went on to explain how the company had experienced difficulty in raising the necessary capital, how at last some portion of the capital was raised, and a generating station erected at Radcliffe. Coming to the provision of the present Bill, he said that Clause 5 read as follows:—"In addition to the powers conferred upon the company by the Act of 1900, and notwithstanding anything in that Act to the contrary, the company may supply energy within the area of supply (*a*) to lighting authorities, and (*b*) to persons requiring a supply for power." Then there was the following provision :—"The company shall not under the powers of this Act supply energy for lighting purposes, except to lighting authorities, provided that the energy supplied to any person for power may be used by such person for lighting any premises on any part of which the power is utilised." That was a matter which was raising some dispute before their Lordships. "Secondly, the company shall not under the powers of this Act supply energy (except to any railway company for traction purposes or for lighting vehicles drawn by such traction) in any area which at the date of the passing of this Act forms part of the area of supply of any authorised distributors other than the company, without the consent in writing of those distributors, or in any urban district the Council of which may be authorised to supply energy under any provisional order hereafter to be granted under the Electric Lighting Acts, and in respect of which order application shall have been made to the Board of Trade before January 1st, 1908, without the consent in writing of such Council." Their Lordships would see that the Councils would be in as good a position as if they had their orders to-day. When the Bill was first deposited there was a certain clause which gave an appeal from the refusal of any U.D.C. to the Board of Trade, but that raised a storm of opposition, no fewer than 68 petitions being directed against the company by Councils who wanted to have a free hand in the matter. Eventually a conference was held with all the local authorities, and the clause which was in the Bill to-day was agreed to. The Councils had an absolute veto. One other clause—14—he wished to draw the attention of the Committee to. Under that clause the following enactment was made, and it was on that that something was said by the only opponent they had against them that day:—"It shall be lawful for the company within the area of supply to lay down, maintain, repair, alter, and use pipes for conveying water and any material, matter or thing used by them in or resulting from the process of generating or transforming electricity to or from any generating station of the company, and the provisions of the Water Works Clauses Act, 1847, with respect to the breaking up of streets for the purpose of laying pipes, shall, so far as applicable, extend and apply to the laying down, repairing, altering or removing of pipes for such purposes, but nothing contained in this Act shall authorise the company to break up any street except with the consent in writing of the local and road authority, or to supply water to any person." Counsel then went on to explain the company's views on the petition of the Rochdale Canal Co., who were the only opponents which he had referred to, and dealt at some length with some correspondence which had passed. The Canal Co., he continued, were really asking two things. They said, "Your petitioners are the owners of the Rochdale Canal, which extends from Sowerby Bridge, where it joins the Calder and Hebble Navigation, to Manchester, where it joins the Bridgewater Canal. The Rochdale Canal is an important navigation, forming a link in the through water communication between the east and west coasts of England, and there is a large public traffic upon the navigation, and it is to the utmost importance to your petitioners and the public that there should be no interference with the free and uninterrupted passage of traffic along the canal." What the Canal Co. objected to, Mr. Ram explained, was that the Bill would enable the promoters to carry their mains, wires, cables, water pipes, &c., across the canal by means of bridges. The Canal Co. objected on the grounds that the fabric of the bridges, and consequently the stability of them, would be interfered with. There was, however, said learned counsel, a case which had been already decided, "Glasgow Corporation *v.* Glasgow and South-Western Railway Co.," in which it was declared by the House of Lords that undertakings such as the promoting company, carrying anything over the bridge of a canal, could not touch the fabric at all.

The Hon. J. D. Fitzgerald, K.C. (for the Canal Co.): I do not think it decided that.

Mr. Ram said that he thought it did. In any case the Electric Lighting Clauses Act gave the petitioners the fullest award of an arbitrator. The petition further stated that the Canal Co. would be unable to remove or alter any of their bridges, but that was a little audacious, for they could not move a bridge without Act of Parliament. Then the Canal Co. was asking for something quite new. They said, "The Bill as deposited contained a power to the company to supply energy to the proprietors or trustees of any canal or navigation, but this provision has been struck out of the Bill in the House of Commons. It would be to the interest of your petitioners and the public that the company should be authorised to supply energy to canal companies for traction purposes, and they submit that if the Bill is passed, it should only be on the condition that the provision in question is restored to the Bill and proper provision made for the protection of your petitioners in respect of matters hereinbefore referred to." Section 5, Sub-sec. 2 of the Bill contained these words: "The company shall not under the powers of this Act supply energy (except to any railway company for traction purposes or for lighting vehicles drawn by such traction) in any area which at the date of the passing of this Act forms parts of the area of supply of any authorised distributors without the consent," and so forth. It was true, in the first instance, the Bill contemplated putting in the word "canal," as well as railway company, but that was one of the matters on which the local authorities felt most strongly, and at the conference with them the word canal was struck out. They felt that if a canal did want a supply, they (the local authorities) ought to supply it themselves. Mr. Ram, in conclusion, questioned the *locus* of the Canal Co. to be heard. The Committee, however, decided that the *locus* should be granted.

Mr. Francis E. Gripper, the managing director of the promoting company, was then called, and bore out counsel's opening statements. The company, he said, had spent between £300,000 and £400,000.

Mr. A. E. Aitken, the town clerk of Accrington, was also called to speak as to the conference, and this concluded the case for the promoters.

The Hon. J. D. Fitzgerald, K.C., for the petitioners, said that he would call his evidence before addressing their lordships.

Mr. C. R. Dykes said that he was the general manager and secretary of the Rochdale Canal Co. The canal was a very important navigation, and if they could get a cheap supply of electricity from a company like the Lancashire Co., it would be to the interest not only of the canal, but also of the public. He did not think it would be possible for his company to get such a supply as they would want from the local authorities. In any case it would mean getting a supply for every few miles of canal, and that would necessitate breaks. Besides, the methods of supply would be different.

On Friday the Committee, having heard the Hon. J. D. Fitzgerald on behalf of the Canal Co., passed the preamble of the Bill, and it was ordered to proceed.

Edinburgh Corporation Tramways.

This Bill came before Lord Clifford of Chudleigh's Select Committee of the House of Lords last week.

Mr. Pembroke Stephens, K.C., opened the case for the promoters. There were, he said, 12 lines of tramways proposed by the Bill, two of them being short connecting lines. Tramway No. 1 was a double line 6·53 chains in length, commencing by a junction with the existing tramway in Gilmore Place. No. 2 was also a double line 4·2 chains long, running from the existing tramway in Gilmore Place, and terminating on the east side of Leamington Terrace. No. 3 started from the existing tramway on the east side of Viewforth, terminating at the existing line east of St. Peter's Place, and was a double line 4·32 chains in length. Tramway No. 4, a double line, was 6 furlongs 6 chains in length, and commenced at the existing line in Granville Terrace, terminating at Polworth Terrace. These were all lines referred to in the Bill under the heading of "doubling." The new tramways proposed commenced with No. 5; this was a single line with passing places, and commenced by a junction with No. 4 at Polworth Terrace. Proceeding in a south-westerly direction, it terminated opposite the entrance to Craiglockhart Safety Ponds, the length being 4 furlongs. Of the other tramways No. 9 was a double and single line 8 furlongs 7·17 chains long, of which 8 furlongs 3·84 chains

was double line. It commenced by a junction with the existing tramway in Leith Street, and passing in a curved line in a north-westerly direction along the roads or streets of Broughton Street, and in a north-easterly direction along the roads or streets of Bellevue, terminated at Broughton. No. 10, a line 2 furlongs 6·27 chains in length, commenced by a junction with the previous line, and ran to the existing tramway terminus in Canonmills. The tramway lessees were renewing their opposition so far as the Broughton line was concerned, this being the line which the House of Commons had empowered the Corporation either to electrify or to run as a cable tramway. The tramways in Edinburgh, counsel continued, were leased and worked by the Edinburgh and District Tramway Co., but all the expenditure in connection with them had been borne by the Corporation, a sum of something like £1,300,000 having been spent on them. It was part of the agreement with the company that a change from cable to electricity could not be made without the consent of the lessees, who had already paid for the change from horse to cable. The position with regard to the Broughton line, the line about which the company was petitioning, was that there was now a supply of electricity available, and this supply had been brought in by means of the Leith system and that beyond Joppa. The Corporation had the power to acquire a joint interest in the Leith line, and they would be able to make use of that arrangement when the connecting line was made. The Leith Corporation were anxious that Edinburgh should use their system, as it would aid development, so that a new situation had arisen, it being that the door had been opened for the electrification of the tramways. The Tramways Co. were, he contended, the means by which the change should be made, though the Corporation could not, of course, ask the company to change their whole system and pay over again the cost of the transformation. In the common interests of the Corporation and the company, and also in the public interest, there was nothing to prevent an interchange of views, and he submitted that it would be quite possible for the systems between Leith and Edinburgh to be made continuous. What the company appeared to demand was that Edinburgh should be limited to the cable system.

Continuing his speech on Thursday last week, Mr. Pembroke Stephens said that in one paragraph of their petition the company objected to any extension of the tramways as being unnecessary, and yet in another paragraph they spoke about a limitation of the period of construction.

Witnesses were then called.

The Lord Provost (Sir Robert Cranston) spoke to the proposals in the Bill having been adopted unanimously by the Town Council, and said that they were generally regarded as necessary in the interests of the Corporation, the citizens, and also of the company itself. The Broughton tramways would form a convenient starting point for a further development in the future, and all the Corporation wanted was power to use the most convenient system of traction. The Corporation had the means of providing electricity, as they sold motive power, and could meet any demand likely to be made for the line. The company could get cheap power from them, and no doubt would do so.

Cross-examined by Mr. Balfour Browne, K.C. (for the company), Witness said that it seemed to him perfectly natural that the line should be worked electrically, although it was in connection with a cable system. A beginning had to be made. He did not agree that a loss would be made on the line, and would not admit that the company would be made to work a line which would not be remunerative. It would be worked on the overhead system.

Mr. Thomas Hunter, the town clerk of Edinburgh, explained the nature of the agreements with the company, and gave general evidence in support of the scheme.

Sir Alexander Kennedy, chief consulting electrical engineer to the Corporation, said that having considered the scheme, he considered it workable. An adequate supply of current could be obtained from the Corporation's generating station, for the line was short, and would not require a great deal of power. He could see no difficulty in taking the overhead system over a cross-over junction with a cable line.

The case for the company was then opened by witnesses being called.

Mr. Hall Blyth, C.E., examined by Mr. Balfour Browne, said that if it could be shown that the proposed tramways were unnecessary the lessees would not be bound to work them. The Corporation were getting a considerable profit out of the company, and he considered that to put down a short electric line in connection with a cable system was simply absurd, and would mean a serious loss.

On Friday Mr. Stephen Sellon was called in support of the company's case, and gave it as his opinion that the change of cars which the electrified portion would entail would be fatal to the enterprise.

Witness was being cross-examined at some length by Mr. Stephens, when the Chairman of the Committee asked if there was any chance of an agreement between the parties. The opinion of the Committee, he said, was that it was hardly fair to ask the company to work a small portion of the line on a system totally different from the rest. The Committee were in favour of the tramways, but if made on a different system they thought it ought to be done outside the agreement.

Mr. Balfour Browne said that if the new line was made on the cable system the company would work it.

Parties having conferred, a clause embodying the views of the Committee was ultimately agreed to, so that the tramway in question will not be electrified.

Clauses were then considered, and the Bill was ordered to proceed.

The Wireless Telegraphy Bill.

In the House of Commons on 13th inst. the Lords' amendments to this Bill were considered. An amendment was moved by Lord Balcarres that the amendments be considered "this day three months." He said that the Bill continued what was virtually a private company monopoly for a further three years. The Postmaster-General ought not to tie his hands for so long, for further developments might take place during the next three years. Mr. Henniker-Heaton said that the Marconi Co. would rather welcome the defeat of the Bill. Mr. J. D. White blamed the late Government for the creation of a monopoly. The agreement of August, 1904, gave the Marconi Co. very strong preference over any other competitor. Under the agreement the privileges of the master patent were extended from 1910 (the date of its expiry) until 1919. Mr. White described the agreement as a most improvident one. Mr. Buxton (Postmaster-General) said that the Bill was carrying out the late Government's policy. The object of the Bill was to enable him to maintain some control over wireless telegraphy, not to give a monopoly to any one company. He intended to encourage all systems, so that the country might experiment and ultimately adopt the best. After a few words from Mr. Lupton, Lord Balcarres withdrew his amendment. Mr. Buxton said that there was nothing to prevent an amending Bill being introduced, if it were thought necessary later.

Second and Third Readings.—In the House of Commons on July 16th the Cumberland Electricity and Power Gas Bill and the Folkestone and District Electricity Supply Bill were read a third time.

Southport and Lytham Tramroad (Extension of Time) Bill and West Yorkshire Tramways Bill were ordered for third reading.

In the House of Commons, on July 12th, the South Wales Electrical Power Distribution Co.'s Bill was read a third time.

In the House of Lords, on July 13th, the Derbyshire and Nottinghamshire Electric Power Bill and the Ascot District Gas (Electric Lighting) Bill passed third reading.

In the House of Lords, on Monday, the following were read a third time:—London United Tramways and Twickenham and Teddington Electric Supply Bill.

In the House of Commons, on 16th inst., the Shoreditch and Stepney Electricity Supply Bill was withdrawn. The Metropolitan Electric Supply Bill was read a second time.

London Electric Supply Bills.—The *Times* says that on 11th inst. the following Bills were withdrawn:—Charing Cross, West End and City Electricity Supply, City of London Electric Lighting, West London Electric Undertakers' Association, London Electric Supply Corporation, and the South Metropolitan Electric Light and Power Bill.

Shropshire, Worcestershire and Staffordshire Electric Power Bill.—In the House of Commons on July 11th, this Bill was read a second time after Mr. Kearley had reported that the opposition of local authorities had been withdrawn, and that the financial support was ample. The House of Lords had inserted a clause requiring £300,000 capital to be set up within 18 months.

Gas and Water Pipes and Electric Currents.—When the Corporation of London (Blackfriars and other Bridges) Bill came before the Lords for third reading on Monday, Lord Welby asked for the insertion of a clause protecting the gas and water authorities in the event of damage to pipes by electric currents, but the Earl of Onslow urged that by precedent these matters were left to the Board of Trade. Lord Newton asked for the appointment of a committee to ascertain the real rights of the question for the guidance of future committees. Lord Welby's amendment was, however, withdrawn.

LEGAL.

Bullen *v.* London United Tramways, Ltd.

At the Uxbridge County Court on 12th inst. plaintiff, a car-driver, claimed compensation from defendants for injuries received in a collision between two cars, one of which he was driving, in a fog, last October. The defendants alleged wilful misconduct on the plaintiff's part by disregarding the rules, and they denied responsibility. Plaintiff was awarded 14s. 10d. weekly for the first six months and 11s. 4d. during the remainder of the period of incapacity.

Chandler *v.* Manchester Corporation.

At the Manchester Assizes on Tuesday Mary Ann Chandler, widow, of Gorton, brought an action against the Manchester Corporation for damages for personal injuries sustained last November while she was travelling in a tramcar. As the car was approaching the pipe storing yard of the Corporation, near Belle Vue, a lurry, heavily laden with pipes, was approaching the yard from the opposite direction. The driver of the car tried to push past, and there was a collision. Plaintiff was awarded £65 damages.

Selling Hired Electric Fittings.

In the Shoreditch County Court on Thursday last week, before his Hon. Judge Smyly, K.C., Mr. James Fuller, a boot manufacturer, of Braintree, Essex, sued Mr. A. Bernstein, a leather merchants' agent, of 119, Finsbury Pavement, E.C., to recover £6 3s. 2d. alleged to have been paid to the defendant for electric fittings which he had no authority to sell. The plaintiff's case was that he took a shop from the defendant at 22, Ilford Lane, Ilford, and agreed to pay £11 for the electrical fittings, an arc lamp and the boot shop fittings. Subsequently he got a demand in from the Ilford District Council for a quarter's hiring of the fittings, and he was then informed that the defendant had never possessed them and had no right to sell them.

Mr. Herbert King, chief clerk in the Electricity Department of the Ilford District Council, said the previous tenant signed a hire purchase agreement in conjunction with the defendant for the electric fittings and arc lamp. The cost of the installation was £6 3s. 2d. The defendant had no right to sell the fittings, as they were absolutely the property of the Council until the hiring had been paid, and could not be moved without their permission.

His Honour gave judgment for the plaintiff for the amount claimed with costs.

Fraudulently Obtaining Electricity.

At the Todmorden Petty Sessions on Thursday, July 12th, Harry Johnson, electrician, Todmorden (manager for Mr. Williams, who has an electrical business in Water Street, Todmorden, but whose establishment is at Preston), was charged with consuming electricity without the same having gone through a meter.

The Town Clerk, who prosecuted, explained that the charge against the defendant was that on June 6th and divers other days he fraudulently abstracted and consumed electricity contrary to the Act.

The principal witness called was Thos. Hilton Holland, electrical pointer and service layer for the Corporation, who said that on June 2nd he took the readings of both Mrs. Bradbury's and Mr. Williams's meters. Mrs. Bradbury's showed 225 units consumed, and Mr. Williams's 180, since last October. Mrs. Bradbury had usually five lights, and Mr. Williams about ten. He paid a second visit to see if he had made a mistake, and found his previous reading to be perfectly correct. In consequence of something Mrs. Bradbury said, he went into the shop on Monday morning, June 11th, and examined a storage cell to see whether it was charging through Mrs. Bradbury's meter. It was not charging. There was a small piece of board in the corner, covering up a piece of casing, similar to the one produced. On looking behind it he found Williams's wire wrapped on to Mrs. Bradbury's negative wire, which was the one which returned to the Corporation cut-out. The insulating material had been cut off the wires, and the metal came in contact. The result was that it cut Mr. Williams's meter out of the circuit. He fetched the borough electrical engineer, Mr. Harold Waring, to see it.

The latter gentleman gave evidence confirmatory of the witness Holland's statement.

Councillor Handley and Mrs. Bradbury were also called.

Defendant, for whom Mr. Craven appeared, denied that he had interfered with the wires in any way.

Mr. Alfred Williams, proprietor of the Water Street shop, said he knew nothing of any interference with the wires.

The Bench, after a consultation in private, came to the conclusion that the wires had been tampered with, and fined defendant 20s. with 35s. 6d. costs, or 14 days' imprisonment

Pursley v. Glasgow Corporation.

Plaintiff, a labourer, claimed £500 damages for the death of his wife, who was fatally injured by an electric car last October, when crossing Eglinton Street. The action has now been taken out of Court by plaintiff having accepted £125 in settlement of his claim

BUSINESS NOTES.

The Barcelona Supply Works.—The Compania Barcelonesa de Electricidad, of Barcelona, is one of the Spanish undertakings which are closely associated with the German group of the Allgemeine Electricity Co., and whose shares are largely held by the investment concern as represented by the Bank for Electrical Enterprises, of Zurich. At present the Barcelona company works a concession which is not fixed by any definite term, although the right to supply light and power is not exclusive. The generating station contains plant of a total of 8,500 H.P., and the extension now in progress will increase this to 12,500 H.P. At the end of 1905 the connections to the distributing cables were the equivalent of 166,500 16-C.P. lamps, and agreements have been entered into for the supply of power to several tramways. The ordinary capital of the company amounts to 14,000,000 pesetas, there are mortgage bonds of 6,630,000 pesetas, and, in addition, there are 1,600 founder and other preferential shares. In 1901 the company paid 4 per cent. on the ordinary share capital, in 1902 and 1903 the rate was 5 per cent. for each year, in 1904 6 per cent. and in 1905 7½ per cent. The whole of the ordinary capital has not been issued to the public, inasmuch as shares representing 6,600,000 pesetas are now being offered for subscription by the Deutsche Bank and other financial institutions in Berlin, Zurich, Basle and Geneva at the rate of 118 per cent., and offers are also being received at Barcelona, which is stated to have a population of about 600,000 persons.

The Electro-Medical Apparatus at Newcastle Infirmary.—On page 57 of our last issue we gave a general description of the electrical work which has been carried out at the new Royal Victoria Infirmary, Newcastle, which was opened by the King last week. We are now able to give a few further particulars concerning the electro-medical apparatus that has been introduced. A full equipment of such apparatus is installed, the appliances being of the latest description. As a rule, current for this purpose is obtained from a motor-generator connected to the 480-volt mains, arranged to give current at a lower pressure, though in the operating theatre the secondary battery installed for the emergency lighting is used; this arrangement has the great advantage that it is impossible for a patient to get a shock from the mains when undergoing treatment. The whole of the lower ground floor of pavilion No. 1 is used for electro-medical work, and here are installed a Finsen outfit for the treatment of lupus, &c., Röntgen ray outfits for the treatment of various diseases and radiographic work, and galvanic and faradic apparatus. Preparation has also been made for the use of any other electrical appliance which may be needed in the future. Complete outfits for cautery and other purposes are fitted in the operating theatre and in the out-patients' department, and these can be used for lighting small incandescent lamps as well. Arrangements are also made in each ward to enable electro-medical appliances to be used. The entire electrical equipment was installed by Messrs. Falconar, Cross & Co., of Newcastle.

Manufacturing in Belgium.—It is stated in the report of the Ateliers de Constructions Electriques de Charleroi that the company took over the Charleroi works in July, 1904, and that in the following year the value of the orders received amounted to £212,000. The traction department furnished a large number of tramcar motors during 1905, both for Belgian and foreign tramways, and the building of direct and alternating current generators of from 1,000 to 5,000 H.P. for various central stations was commenced. In the case of coal mining the company carried out several schemes of transformation to electrical working, and other collieries are expected to follow this example in the future. Among other branches which have occupied the attention of the works is the construction of high tension switchboards, electric cranes for harbour use, travellers for quarries, and installations of lighting and transmission of power for rolling mills, iron and steel works and engineering establishments. At the present time extensions of the works are in progress in order to increase the capacity of production, as this is considered to be a necessary condition if the company is to successfully oppose foreign competition. Indeed, the directors state that the company is in a state of inferiority from the point of view of Customs protection of its manufactures. The Belgian import duties on electrical plant are slight, whereas they are prohibitive in certain foreign countries, especially in the case of Germany. Nevertheless the company has realised net profits which have allowed of the payment of a dividend of 8s. per ordinary share for 1905.

Carbide of Calcium.—The Elektricitäts-werk Lonza, which was originally established by the German Schuckert Co., proposes to make a large extension of works. At present the company, which is principally concerned with the manufacture of calcium carbide and other products of the electric furnace, owns one works of 7,500 H.P. at Gampel (Switzerland), and a second of 6,000 H.P. at Thusis, while a third of 3,000 H.P. is worked on lease near Nice. The share capital of the company amounts to £96,000, which is equally divided into ordinary and preference shares, and bonds of £112,000 have also been issued. The company and the Bosnian Electricity Co., of Vienna, and the Electro-chemical Works, of Hafslund, have formed themselves into a group in regard to the German, Swiss and international markets for the common sale of calcium carbide and ferro-silicon produced by the eight works belonging to the group which has formed the Consortium fur Elektrochemische Industrie of Nuremberg for this purpose. It is now proposed to raise £244,000 by the issue of new ordinary shares to this extent for proceeding with comprehensive extensions and for other objects. One of these relates to the utilisation of a water-power concession of the Visp amounting to from 40,000 to 50,000 H.P., and a second refers to a large water-power over which rights have been secured in France. The Lonza Electricity Works Co., which is also interested in the Société Commerciale du Carbure de Calcium, in Paris, has paid dividends at the rate of 6 per cent. on its preference capital in each of the past three years, while the holders of the ordinary shares received their first return in 1904-5 in the form of a distribution of 3 per cent.

The Printing Trades Exhibition.—At the International Printing Trades Exhibition which is now in progress at the Agricultural Hall, Islington, Messrs. J. H. Holmes & Co. have a large exhibit (jointly with Messrs. Wm. Dawson & Sons (Otley), Ltd., and Messrs. James Salmon & Son) at Stands No. 8, 9 and 10, exhibiting a number of their electric motors of different sizes fitted to printing machinery. The motors shown range from ½ H.P. to a 50-H.P. Holmes-Clatworthy set as used for driving large newspaper rotaries. The Exhibition remains open until July 31st.

Hammersmith Street Lighting.—The UNIVERSAL ELECTRICAL MANUFACTURING CO., of Peckham, have just completed the alteration of the Hammersmith Borough Council's street lighting lamps (some 170 in number) from rectified to alternating current. The actual alterations to the lamps, including supplying all the necessary switchboards, choking coils, substitutional resistances, additional domes, &c., have been carried out by the company, the re-fixing, changing, and altering the circuits having been done by the Council's own workmen under the direct supervision of Mr. F. Hill, the chief assistant engineer. We understand that not a single lamp was out on any evening during the reconstruction.

The Electrical Installation at Cape Copper Works.—The *Western Mail* says that about three months will be required to complete the large work of re-organisation which has so far been ordered at the Cape Copper Works, Swansea. The work, which has been proceeding for about three years, includes the complete re-organisation of the electric lighting and power plant, and, to a large extent, the laying down of electric haulage plant in substitution for horse haulage. The work, which is being done under the direction of Mr. Money-Kent, consulting engineer, of London, is costing about £50,000. "It has necessitated a considerable amount of re-building, amongst it the erection of a new power station, which replaces eight old stations scattered through the works, and unifies the system. The object of this extensive re-organisation is to save power and labour, and already the consumption of coal for production of power has been reduced 40 per cent. When this work is completed it is probable that the company will order further work for electric haulage, &c., which will entail an expenditure of about £100,000, and when this is completed they claim that they will be able to produce copper at a lower cost than at any other works in the United Kingdom."

Scientific Instruments in Switzerland.—The Swiss Federal Council has prepared a legislative scheme in regard to weights and measures, and the reorganisation of the national standardising bureau which is located at Berne. It is stated in connection with the Bill that people of scientific professions obtain their instruments from abroad with the standardising or certificates of foreign standardising offices, and it is asserted that these are frequently forged. As a consequence, it is alleged that the production and export of measuring instruments of precision in Switzerland are very difficult or impossible, and the industry has therefore declined in recent decades.

Book Notices.—*Die Zweckmässigste Betriebskraft.* By Frederick Barth. Vol. I, Steam-driven Motors; Vol. II, Miscellaneous Motors. Leipzig: J. G. Göschen. Price 80 pf. each.—These two little volumes contain an excellently arranged discussion of the various problems which have to be considered in determining the most suitable prime mover to use under any given working conditions. The deciding factor is, throughout, recognised to be the true cost of the horse-power-hour, allowing for reasonable depreciation of plant, interest on capital, &c., and, as an aid to arriving at this cost, a set of 44 simple tables is given, based on recent market prices, and showing the cost per B.H.P.-hour for installations of various sizes using the various sources of power and running for various numbers of hours per day. These tables are the chief feature of the book; and although exception may be taken to some of the actual prices inserted, the relative importance of cost of fuel, capital cost of machinery and floor space, depreciation, &c., in deciding the cost of the B.H.P.-hour is admirably brought out. Vol. I deals exclusively with steam-driven machinery, including steam turbines and exhaust steam motors. Vol. II contains chapters on Gas Engines, Oil Engines (including Diesel engines), Suction Gas Engines, Acetylene Motors, Windmills, Water Wheels and Turbines, Hot-air Motors, Electric Motors and Compressed-air Motors. In each case a clear but concise description of the motor, its method of operation and its auxiliary apparatus is given, as well as the above-mentioned table of costs. Technical terms are avoided as far as possible. The author gives sound critical comparisons in cases where two or more engines (such as the Diesel engine and the suction gas engine) are close competitors for one particular class of work, so that even the non-technical small power user, for whom the book seems specially designed, should find little difficulty in deciding on the most economical form of power under any particular conditions.

Die Gleichstrommaschine. By C. Kinzbrunner. Leipzig: G. J. Göschen. Price 80 pf.—It is difficult to see what useful purpose can be served by a book designed on the lines of this one. It is obviously intended for the use of beginners and yet does not attempt to explain many of the formulæ used and many of the statements made. It is divided into short chapters dealing with the calculation of direct-current machines, their losses and heating, mechanical construction, methods of excitation, testing and erection; but owing, no doubt, to the very small space available, the treatment is in most cases very cursory. The important commutation problem is quite inadequately dealt with, even for so small a book, whilst amongst other omissions the absence of all diagrams showing the methods of connecting up armature windings may be mentioned. The information given is, on the whole, accurate, though, owing to its condensed form and the absence of worked numerical examples, the statements are sometimes ambiguous.

Physical Chemistry for Electrical Engineers. By J. Livingston R. Morgan, Ph.D., Professor of Physical Chemistry in Columbia University. New York: John Wiley & Sons; London: Chapman and Hall, Ltd. 1906. Price 6s. 6d. net.—This is a little book of 200 odd pages, which, as the author is careful to point out in a sufficient number of footnotes, is intended to serve as an introduction to a larger volume that he has prepared on physical chemistry in general, as well as to those portions of physical chemistry which more nearly concern electrical engineers. The special aim Dr. Morgan has kept before him, has been to present his subject free from "hypothesis," *i.e.*, in the light of experiment only; and this has led him to indulge here and there in new terminology in a manner that may, perhaps, prove as confusing as it is intended to be enlightening. We have no right now, as we undoubtedly had a few years back, to complain of a dearth of text-books on physical chemistry; in fact, we now possess plenty. Nevertheless, Dr. Morgan has given us a useful contribution in the volume now under notice, a volume which appears sound, and commendably free from blemishes for a first edition.

Practical Motor-Car Repairing: A Handbook for Motor-Car Owners and Drivers. By Eric W. Walford. London: Percival Marshall and Co. 1s. net.—Literature—both technical and non-technical—appertaining to motor-cars is extending at almost as rapid a rate as is the automobile movement, scarcely a week now passing without an addition being made to the motorist's library. Naturally all are designed by their authors to fill "a long-felt want," and while this does not always prove to be the case, Mr. Walford's book may deservedly be admitted into the category of those which fulfil a useful purpose. It forms No. 6 of the series of Marshall's Practical Manuals, and is intended to afford to motor-car owners, drivers and repairers some serviceable hints with regard to the maintenance of a motor-car in good running order. As representing the electrical side of the automobile movement, we may, perhaps, cavil at the author's adopting such a general title as "Motor-Cars," seeing that he restricts his attention to one form of automobile—that in which a petrol engine is employed to furnish the motive power—but setting this aside, the little work may be recommended to all "petrolites." Mr. Walford, in a series of nine chapters, takes the reader through the various parts of the machine, dealing with each in a clear and simple way. Starting with the motor, the grinding-in of the valves, the adjustment and renewal of the bearings, and valve timing are but a few of the subjects dealt with. Similarly in the subsequent chapters, ignition, water circulation and carburettor troubles are lucidly treated, these being followed by notes on the transmission, frames, tires, &c. One of the most useful sections of the book is that in which the points to which a stoppage in the regularity of operation of any part of an automobile may be due are set out in tabular form, the "effect" being arranged in one column, and the likely "cause" or "causes" in another. The work concludes with a number of hints which should prove handy for reference in the repair shop.

Post Office Telegraphs. Technical Instructions XIII. The Construction of Aerial Lines on Roads and Railways. Wyman & Sons, Ltd.—This publication, (for it can be purchased by the public) is practically a complete statement of the methods of construction of the aerial telegraph system as carried out by the British Post Office. A series of instructions of this kind has for some time, we believe, been in use in the Postal Telegraph service, but they were issued for the use of the staff only, and were not available to the public; the change of policy (for we presume it is such) which has enabled those outside the service to obtain copies will be much appreciated, and we trust it will not be confined to the issue of "Technical Instructions XIII" only, but from No. I to—whatever number they may run to. The "Instructions" are necessarily drawn up with more attention to detail than would be the case if the publication were one of the nature of an ordinary text-book, but at the same time there is little which will not prove of general interest also; in fact, the Instructions really form a most complete and carefully-compiled treatise, and should be of great value to all who desire information on the subject dealt with. The following is a general summary of the contents:—I, Surveys and Wayleaves; II, Poles; III, Pole Arms, Fittings, &c.; IV, Wires, Description and Erection; V, Pole Test Boxes; VI, Numbering Wires and Recording Circuits; VII, Overhouse Wires; VIII, Working Parties and their Equipment; IX, General Instructions; X, Regulations for the Prevention of Accidents; Appendix. A noticeable feature in the compilation is the general "get up," which is greatly conducive to clearness and easy reference, the different paragraphs being well spaced out. The whole work, it may be mentioned, consists of 150 pages, foolscap size. Those who may recollect the early days of the Postal Telegraph Service, will, doubtless, note how vastly more complicated are the conditions existing at the present day; the construction of a line, which 30 years ago would be considered a great work, would be looked upon as of but little account now, whilst the yearly amount of stores of all kinds required for maintenance and for new works, would, we fancy, surprise the outsider. One has only to look at the Parliamentary Estimates of 30 years back, and to compare them with those of the present day, to realise what an immense increase in staff has had to be made in order to deal with the present day work. To criticise the compilation is hardly a task to be undertaken; the publication is practically a Government "blue book" (though actually not of that colour), giving information for the guidance of the staff, and not a "book" published for the financial profit of the compiler or compilers, but we must say that it shows distinct indications of careful "editing," and can fairly be called a most creditable production. The price—1s. 6d.—no one will be found to complain of, we should imagine, as being exorbitant.

British Engineering Standards Coded Lists. Vol. III. London: Robt. Atkinson (London), Ltd. 1906. Price 25s. net.—This volume, one of the series issued by authority of the Engineering Standards Committee, contains the findings, reports and specifications of the Committee, arranged in a convenient form, and deals with copper conductors and thickness of dielectric, telegraph

material, standards for electrical machinery, tubular tramway poles, and trolley groove and wire. These we have already dealt with, as they appeared in the form of interim reports. The work, however, contains much more than would be gathered from the foregoing statement. Besides a short history of the Committee, and particulars of the composition of many of the numerous sectional and sub-committees, there is a list of publications issued by the Committee, particulars of the engineering institutions of this country, and a series of complete and comprehensive telegraphic codes corresponding to the details of the specifications and to inquiries and replies relating thereto, covering also a great variety of phrases of allied interest. Weights, prices, dimensions, &c., are also coded, and a large number of code words are added with blanks for the insertion of special phrases, to be filled in by arrangement between users of the lists. The work should certainly prove of very great value to engineers and manufacturers, as it combines so many useful features. The volume is well printed and bound. The two previous volumes contained similar matter relating to steel and iron work, rails, pipes, screw and pipe threads and gement. The whole constitutes an example of enterprise and utility worthy of the highest commendation.

"ransaction of the N.E. Coast Institution of Engineers and Shipbuilders." Vol. XXII, Parts 6 and 7, June, 1906. Newcastle-on-Tyne: The Secretary of the Institution.

"team Turbines and Turbo-Compressors, Their Design and Construction." By Frank Foster. Manchester: Scientific Publishing Co. 10s. 6d. net.

The Universal Directory of Railway Officials for 1906. London: The Directory Publishing Co., 3, Ludgate Circus Buildings. 10s. This is the twelfth year of publication of this most useful compendium on the railways of the world and those connected with the Practically all the tramways worked by power in the United Kingdom are also included in the book. We have reviewed previous editions at length, so it will suffice to say that the 1906 edition has been carefully revised and brought up to date, and several additions have been made.

"The Institution of Electrical Engineers' Electrical Handbooks for London; Manchester, Liverpool and Districts; Glasgow, Edinburgh, and Newcastle and Districts; and for Birmingham, Leeds and District." London: The Institution.

"Working Hints for Suction Gas Producers." By A. Flurscheim. London: The *Gas and Oil Engine Record*. 1s. net.

"The Electrical Nature of Matter and Radioactivity." By H. Jones. London: Archibald Constable & Co. 7s. 6d. net.

The Concise Interest Calculator. By A. M. Campbell. London: Crosby Lockwood & Son. 2s. 6d. net.—The tables contained in this work are based on the "products" method, and the author claims to have eliminated the defects of previous tables of this kind. A new decimal rule for the division of money by 365 is given, and also a table for computing the number of days from month to month.

Consular Notes.—SPAIN. — The British Consul at Cadiz, in a recent report, states that the electric tramway line to St. Fernando from Cadiz, a distance of 14 miles, is nearly completed. The important town of San Fernando will be lighted by electricity supplied by the company. It is intended to continue the line to Chiclana, Tarifa, and eventually Algeciras. The line will be a great boon to Cadiz, whose population is unused to travel, the majority having seldom gone beyond the narrow neck of sand which connects this historic city with the mainland. The electric tramway will encourage movement, and by the freer circulation of money render general assistance to trade. With an extension of the line inland, towns will be opened up, and their produce rendered available for the larger centres. In short, with small advertisement, the electric railway is literally on the road to bring to the cities of the bay that increase of prosperity which was believed to await the construction of a railway.

The British Consul at Malaga reports that the electric works at the Chorro, designed to utilise the falls of the River Guadalhorce for the creation and transmission of electrical energy for industrial purposes to Malaga, a distance of some 32 miles, continue to supply power to a number of industrial enterprises, including the English and German electric light companies, the tramway companies and various manufacturing establishments. The railway from Malaga to Torre del Mar is now in course of construction, and it is stated that the railway from Malaga to Coin will shortly be commenced. The company which has subscribed the capital for these undertakings is a Belgian one—Sociedad Hispano-Belga de ferrocarriles y tranvias—formed in Antwerp with a capital of 3,000,000 fr., for the working of railways and tramways in Spain, as well as for the development of electric enterprises. Work has been commenced during the past year in connection with the electrification of the local system of tramways, which is being extended considerably in various directions. The new cars may be expected to start running some time in the current year.

The British Consul at Corunna reports that a project has been in existence now for several years for prolonging the city tramway lines to a neighbouring village some 4 miles out, with a view to facilitating the bringing in of market produce by the peasantry of the surrounding country, and it was meant that the motive power of this extended line should be supplied by the electric company, electricity being also substituted in the city itself for the present system of traction by mules. The contemplated work has not even been commenced. The electric lighting companies, of which there are two, now obtain their power from a fall of water near Puentedeume, about 15 miles from Corunna, instead of using steam, as was formerly done.

SWEDEN.—The British Vice-Consul at Halmstad reports that the organisation of the Sydsvenska Elektriska Aktiebolaget (the South of Sweden Electrical Co., Ltd.) is an event of considerable importance to industry. The company has been formed with a view of buying the waterfalls of the River Lagan, and from these to supply power and lighting not only to Halmstad, but also to Helsingborg, Landscrona, Malmo and other places. The community of Halmstad owns an extensive tract of land adjoining the harbour, and naturally anticipates great advantages from being able to obtain electric power at a low rate for present industrial enterprise, and such as undoubtedly will spring up in the immediate future. This company intends to improve the falls, so that they may furnish about 14,000 H.P., and later on to introduce further improvements, so as to obtain a considerably greater amount of power, or about 30,000 H.P.; and it is intended to supply this power so cheaply as to exclude competition from any other source of power at present available.

ROUMANIA.—The British Vice-Consul at Braila reports that that town is now lighted throughout by electricity, and the electric light is being introduced into banks, shops, private houses, &c.

GERMANY.—The United States Consul at Crefeld reports that the Rhein-Westf. Elektrizitätswerk, of Essen, has installed a large electric plant, and uses the gases from the coke furnaces to furnish the power to drive the dynamos. The system has been in operation for some time, and is so successful that the company is entering into contracts to supply electrical energy.

Catalogues and Lists.—MESSRS. R. W. PAUL, London, N.—Leaflet describing the "Callender" cable calculator, designed for calculations in connection with electric cables, but applicable to other purposes. The calculation is purely mechanical, given the requisite data.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—New pamphlet giving illustrations, prices and dimensions of their standard design of special combination house service fuseboards.

MESSRS. ERNEST F. MOY, LTD., Camden Town, N.W.—16-pp. catalogue (No. 13), giving illustrated particulars of various types of Mordey's patent fuses. Prices and dimensioned drawings are included. A table is printed of Imperial standard wire gauge equivalents in decimals of an inch and in millimetres.

MESSRS. CROMPTON & CO., LTD., London, E.C.—New pamphlet (D28) giving illustrated descriptions, together with prices, weights and dimensions of their standard motors for continuous-current circuits. Among the applications illustrated are motor-driven lathes, an oil cake-breaker, a chaff cutter, a fan and a centrifugal pump.

MESSRS. JAEGER BROS., 47, Victoria Street, S.W.—Catalogue of 68 pp., showing and pricing a large variety of electrical accessories, including lamp and key holders, tumbler and rotary switches, wall plugs, ceiling roses, fuseboards, adapters, ball fittings, hand lamps, terminals, main switches, and so on. The catalogue is clearly printed, fully illustrated and well arranged.

MESSRS. JAMES HOWDEN & CO., Scotland Street, Glasgow.—An eight-page publication, giving a list of corporations, public institutions, railways, lighting and tramway companies, collieries, works, and so forth, for which their double-acting high-speed enclosed engines have been installed. The total B.H.P. is 28,221, of which 5,293 B.H.P. is for corporations and 3,870 B.H.P. for lighting, power and tramway companies.

MESSRS. WHITEHEAD & PORTEOUS, Leeds.—Leaflet describing their Stereo-matrix moulding machine.

THE CYCLONE GRINDING WHEEL CO., 2 and 3, Tower Royal, E.C.—Circular giving particulars of their cyclone "B B" grinding wheels, together with instructions to users. Prices are given of pure corundum and emery and corundum wheels.

CALMON ASBESTOS AND RUBBER WORKS, LTD., London, E.C.—Revised list (also samples) of their Calmon asbestos slate, notifying advances in prices owing to rise in raw materials. The "S W" quality is for electrical insulation purposes, and this has been used for some of the cable casings of the Metropolitan Railway motor coaches. The other quality "S" is a fire-resisting material for ceilings, partitions, &c. Their asbestos slate is used in the new premises of Waring & Gillow, in Oxford Street.

MESSRS. G. STRAUS & CO., LTD., Upper Thames Street, E.C.—Illustrated catalogue and price list (Section B) of various types of electric bells, bell material, indicators, door, floor and other contacts, wiring sundries, electro-medical coils, toy motors, &c. This is the ninth edition of this section of the firm's catalogue.

MESSRS. SIEMENS BROS. & CO., LTD., London.—Pamphlet No. 201, containing a finely illustrated description of their works at Woolwich, showing the submarine cable departments, the wire and cable covering shops, electric light and power and telephone cable shops, the saw mills and joinery shops, instrument and battery shops, also the power house, show-room and main office buildings.

For Sale.—MESSRS. WHEATLEY KIRK, PRICE & CO., will on July 31st and August 1st, offer for sale by auction the freehold works, stock of motors and parts, machinery, &c., of the City and Suburban Electric Carriage Co. (1903), Ltd. (in liquidation).

MESSRS. P. HUDDLESTON & CO. will on July 24th offer a quantity of electrical apparatus and fittings for sale at Sheffield. Some details appear among our advertisements.

The Holidays.—A further parcel of interesting holiday resort hand-books has been issued by the Health Resorts Development Association, of 2, Gray's Inn Road. These are published for the Town Councils of Southend, Harwich, Malvern, Falmouth, and Kingston-on-Thames respectively, and a card addressed to the town clerk at any of these places will enable any reader to secure a copy.

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Bankruptcy Proceedings.—T. F. L. Rene.—The public cross-examination was held on July 13th at the London Bankruptcy Court, before Mr. Registrar Brougham, of Theodore Ferdinand Levy René, electrical engineer, Elsmore Road, Catford. In reply to Mr. E. S. Grey, Official Receiver, the debtor stated that in 1903 he came to this country with £200 representing previous savings. He had acted as agent in New York in the name of Levy, that being his surname. No bankruptcy proceedings had ever been taken against him, nor was there any ground for the suggestion that he absconded from New York with the property of his principals. On his arrival in England he commenced business as an expert chemist and electrical engineer at Elsmore Road, Catford. In September, 1903, he took an office at 6, Snow Hill, where he sold electrical accessories for motors under the style of L. René, and in May, 1905, he took additional rooms at the same address, and traded as the Holborn Rubber Company. Both businesses were successful, and so increased as to require more capital than he had at his command, and in December last he formed the business into L. René & Co., Ltd., with a capital of £8,000. As vendor witness received £7,000 in fully-paid shares of the company, with one half share of the profits for 30 years, and the appointment of managing director of the company at £300 per annum. He gave 3,000 shares to others who assisted in the promotion, and on February 5th, 1906, he transferred the remainder to his wife for a nominal consideration. At the date of the receiving order he still held the position of managing director of the company. Witness attributed his failure to law costs in an action to recover a debt in which he was unsuccessful. He only owed £63, and disputed a claim of £300 that had been made against the estate, whilst his only assets were "bad book debts for £176." The debtor was examined by the trustee and creditors, and was then allowed to pass.

S. R. and B. R. Cohen.—The public examination was held last week at the London Bankruptcy Court, before Mr. Registrar Giffard, of Samuel Raphael Cohen and Barnett Raphael Cohen, lately trading in partnership as Cohen Bros., manufacturing electricians and opticians, 6, Bank Parade, West Kensington. The debtors stated that they commenced the above business in December, 1902, and in July, 1904, added that of motor engineers. The petitioning creditor joined them in partnership in October, 1904, and contributed £225 to the business. A dissolution was effected in March, 1905, under which the partner took over the stock and book debts in consideration of £233 11s. to be applied in payment of the firm's liabilities of £316 9s. 9d., leaving them (the debtors) jointly and severally liable for two-thirds of the deficiency. They now owed £60 6s. 9d., and the only asset was a bank balance of 6s. 8d. The examination was concluded.

Trade Announcements.—The Union Electric Co., Ltd., announce that on and after July 23rd, their head office, works, stores and test room address will be Park Street, Southwark, London, S.E., where they had secured new premises, nearly four times as large as the present ones.

The Wandsworth Electrical Manufacturing Co., Ltd., of Birmingham, have appointed Mr. S. Mansel Jones to represent them in South Wales. He will hold a stock of their manufactures at his depôt, 63, Wind Street, Swansea.

Messrs. Green & Trevett, electrical and mechanical engineers, of Cape Town, have dissolved partnership, and the business will in future be carried on by Mr. Chas. G. Trevett solely. Mr. Trevett has also opened a branch office and showroom at East London, under the management of Mr. E. A. Shaw, A.M.I.E.E.

The telephone numbers of the St. Pancras Borough Council electricity and public lighting department have been changed to the Post Office, Nos. 512 and 513 "Mayfair."

Annual Outings.—On Saturday, July 7th, the staff and employés of the Paisley Corporation electricity department, along with a few friends, journeyed to the English Lake district for their annual outing. The party went by train to Penrith *vid* Carlisle (lunch being served *en route*), thence per motor-cars to Pooley Bridge. Here the ss. *Raven* was joined for Patterdale, tea being served at the Glenridding Hotel. A vote of thanks, on the motion of the chief engineer, Mr. C. F. Parkinson, was accorded Ballie Fisher for his kindness in being with them that day.

The employés of Messrs. Stegmann & Co., of Clapham Junction, spent a most enjoyable day at Brighton on the 7th inst. Dinner was partaken of at the Queen's, and a motor trip whiled away the afternoon.

The annual holiday of the employés of Simplex Conduits, Ltd., took place on the 14th inst. The party, which numbered 200, left Birmingham by special train for Tewkesbury early in the morning, accompanied by the managing director, Mr. L. M. Waterhouse, and the heads of the various departments and branch offices. The early part of the day was occupied by sports, the various events and races being keenly contested. Luncheon was served in a large marquee on the river bank, and at the conclusion the prizes were presented by Mrs. L. M. Waterhouse. The afternoon was spent in boating and river trips, a steamer being specially engaged for the occasion. The party were conveyed back to Birmingham by special train at 8 o'clock, bringing to a conclusion the most successful outing yet organised by the company. A special vote of thanks was accorded to Messrs. Randall and Spiller for the excellent arrangements made.

The staff of the Harrow Electric Light Co. went for their first annual outing last week, when they journeyed to Reading, where the first event took the form of a shooting match on the miniature rifle range of the Reading Electric Supply Co. The Harrow team were defeated by the homesters by 15 points (254—239), the best six shots out of nine. After a trip on the river by steam launch, dinner was served at the Bull Hotel. Mr. Olver, the engineer, presided, and Mr. Barnes, the secretary, occupied the vice-chair.

Dissolutions and Liquidations.—Mersey Electric Supply Co.—This company is winding up voluntarily, with Mr. J. G. Hodgson, 41, North John Street, Liverpool, as liquidator.

A.C. Electrical Co., Saracen Buildings, Snow Hill, E.C.—Messrs. J. G. Addinell, C. A. Chamberlain and H. Bell Syer have dissolved partnership. Mr. J. G. Addinell attends to debts, and will continue the business.

Electro-Medical Supply Co., Ltd.—This company is winding up voluntarily, with Mr. H. C. Howard, 70A, Basinghall Street, E.C., a liquidator.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—The T.C. has applied to the L.G.B. for a loan of £17,000 for E.L. purposes.

Beverley.—The T.C. has decided to negotiate with Messrs. J. and J. S. Enright for the sale or transfer of the E.L. Order, 1901, for £250.

Birmingham.—It has been decided that the formal opening of the electric power station in Summer Lane shall take place on September 26th. The ceremony will be performed by the Lord Mayor.

Brandon.—The erection of the power station for the electric lighting of the Brandon Colliery and district is now proceeding. The U.D.C. has decided to advertise for tenders for the laying of the mains.

Canada.—Trail.—The electric light plant of the Consolidated Mining and Smelting Co. was burned to the ground recently, and the building and the plant destroyed. The monetary loss is about $16,000, which is fully covered by insurance.

Cleckheaton.—The annual report on the electricity undertaking shows a loss of £95 on the year's working.

Continental Notes.—Italy.—The authorities of the Belluno province have lately granted a concession for a plant to be put down to utilise the water power of the River Ardo for lighting and power purposes in the district.

Austria-Hungary.—The British Consul at Fiume, in a recent report, states that the municipality has under consideration a scheme for the erection of a large electrical plant for the supply of electricity for industrial and domestic purposes at a small cost to customers. Water power will supply something like 10,000 H.P. for the purpose at a cost of about £40,000 to £50,000, and the work is to be carried out within the next two years.

Perranporth.—At the Alfred Mines, Perranporth, an experiment in applying electric power to the driving of a Cornish pump is to be carried out. The Cornish pump is a prominent feature in mining work throughout the county, and the successful result anticipated should do much to encourage the more general adoption of electric power in the tin mining industry. The pump now being erected at Perranporth will have an extra large angle bob, giving an 8-ft. stroke, the barrel being 12 in. in diameter. The pump rod consists of 10-in. or 12-in. square pine logs braced together, balanced by a counterweight on the angle bob. The electric motor is of 35 H.P., and is being supplied by the Brush Electrical Engineering Co.; it will drive through slow motion worm gear and crank-wheel, the latter being linked to the angle bob by a sweep rod. Special starting and controlling gear is provided, so that the pump may be run at any speed from 6 to 12 strokes per minute.

Gravesend.—The Electricity Committee has recommended the T.C. to supply energy to outside arc lamps at 3d. per unit, and to supply to consumers lamps, brackets and carbons, and to maintain the lamps for an additional 1d. per unit.

Hemel Hempstead.—Three companies having intimated their intention of applying for prov. orders for E.L., the T.C. has decided to give each formal notice of objection.

Hove.—The statement of accounts of the Corporation E.L. undertaking for Aldrington for the year ended March 31st, 1906, shows that the expenditure on capital account during the year was £3,327, and the total capital expenditure since January, 1904, was £7,103. The total revenue was £227. The purchase of electricity in bulk cost £89, and the management expenses were £57, leaving a gross profit of £80.

King's Lynn.—The balance-sheet for the year ended March 31st shows a profit of £535, after paying £1,273 interest and £1,814 sinking fund. The balance-sheet has been approved and the profit allocated to the reduction of the suspense account, reducing it from £1,134 to £598.

Launceston (Tasmania).—Below we give details showing the result of the working of the City Council's undertaking for the year ended December 31st last, together with comparative figures for the previous twelve months:—

Year ended December 31st	1905	1904
Total revenue	£13,080	£12,292
„ working costs	5,618	4,391
Gross profit	7,462	7,901
Interest charges	4,973	4,191
Sinking fund charges	1,021	1,531
Net profit	1,468	2,179
Capital expended	£155,314	£139,984
No. of 8-c.p. lamps connected	56,425	44,221
Units sold	793,306	758,424
Maximum load recorded	512 kw.	513 kw.
Total average price obtained	3·58d.	3·55d.
Motors connected	124=424 h.p.	80=218 h.p.
Capacity of plant	1,200 kw.	600 kw.

During 1905 a complete change-over from single-phase to three-phase took place; 58 new transformers and 15 steel and 74 wooden poles were erected, apart from renewals during the year. Arms were altered on 225 poles, 50 miles of cable were removed, and 56 miles erected, and service mains to 1,600 consumers were redistributed between the three phases. Considering the difficulties in maintaining the supply without interruption during the entire change of plant and system, the result of the year's working may be said to be very satisfactory. From the balance of net profit for 1904 and 1905 (£3,647), £2,087 is placed to reserve, bringing the amount standing to the credit of that account up to £3,989, and the remainder, £1,560, is carried forward. Mr. Wm. Corin is the City electrical engineer.

Liversedge.—The B. of T. has revoked the 1900 Electric Lighting Order.

London.—Bermondsey.—Letters are to be sent by the B.C. to the London Electric Supply Corporation and the County of London Electric Supply Co. declining various quotations and proposals made by these companies in regard to the electricity undertaking, and the lighting of the district, but stating that as the Council's business is increasing so rapidly, it is possible that the demand upon the plant may become greater than can be coped with. In that event the Council may ask for quotations for a bulk supply, but until such a contingency arises, further correspondence on the subject is not desired.

St. Pancras.—At the last meeting of the Board of Guardians, it was reported that the cost of lighting and cooking by gas for the year 1901-2 at the North Infirmary, was £756; and by electricity in 1904-5, the cost was £700, thus saving on the 12 months, £55. The chairman of the Committee stated that the wards and building generally were much better lighted and ventilated since electricity had been introduced, and a considerable saving had been effected in the bill for cleaning and decorating the walls, &c. With gas the walls and ceilings got dirty in a few months, whereas now they were in as good a condition after as many years. The electric light was much appreciated by the medical men and the nurses, owing to its great convenience and utility. At the South Infirmary the cost of lighting by gas for the year 1900 was £484, while the cost of electricity and gas together for the year 1905 was £399. At this institution, also, considerable saving had been experienced in the cost of cleaning and decorating since the installation of electric light. It was resolved to forward a copy of the foregoing report to the L.G.B. in connection with an application that gas be replaced by electricity throughout the buildings under the control of the Guardians.

Poplar.—In regard to the now famous inquiry into the administration of the Poor Law by the guardians, Mr. Robb, in conducting the case of the Poplar Municipal Alliance, stated at a recent hearing that he had received a return of the cost of the E.L. installation. Including repairs and renewals, but excluding coal and depreciation, the installation cost £3,294 a year. "One could light a town with a population of 20,000 for that cost. He was chairman of a successful electric light company in the country, and his experience was that many towns could be lighted at the cost of the upkeep of the installation at Poplar Workhouse."

The Inspector said he would postpone the matter until he had seen how the figures quoted by Mr. Robb had been obtained.

Stoke Newington.—Application is to be made by the B.C. to the L.C.C. for sanction to borrow £5,000 for the extension of mains.

L.C.C.—In reporting upon its Bill, thrown out by the Select Committee of the House of Commons, the Highways Committee points out that the Select Committee is unanimously of opinion that the best means of providing for the supply of electrical energy in bulk, and for power and motive purposes, is by one large and inclusive scheme, extending not only over the entire county of London, but also to adjoining boroughs and districts, and that the Council should be the central authority for the purpose of carrying out such a scheme. The Committee is giving careful consideration to the report of the Select Committee, and also to the report made to that Committee by the B. of T. Having regard to the terms of these reports, it is of opinion that the Council should lose no time in preparing a scheme to be laid before Parliament dealing with the supply of electricity in bulk in London and the surrounding districts.

Last Tuesday the Council considered this report by the Highways Committee in regard to the supply of electricity in bulk. The Committee recommended (1) that the standing orders should be suspended so as to allow of the submission of a recommendation after the summer vacation to promote a Bill in Parliament, and (2) that the Committee should be authorised to take such action as was necessary in order that a scheme might be submitted. After a long discussion, the first recommendation was carried by 75 votes to 33. An amendment to the second recommendation was rejected by 67 votes to 32, and the proposal of the Committee was then adopted.

Marylebone.—Following its decision to light Oxford Street by electricity, the E.L. Committee has decided to erect 30 pillars with double and single lights at an estimated cost of £3,000 to £4,000.

Fulham.—The Establishment Committee of the Borough Council reports that the introduction of arc lamps into the Public Baths has resulted in a saving of no less than 30 per cent. in the lighting bill. The cost of installing the arc lamps will be practically saved during the first year of their use. Cables are to be extended, at an estimated cost of £196, to meet a very much increased demand from the London and District Motor-'Bus Co. for energy for power and lighting.

Islington.—In August, 1905, it was resolved that all consumers of electricity for lighting purposes to the extent of 200,000 units per annum should be charged at the reduced rate of 3d. per unit. The Lighting Committee has now provisionally decided that this reduced rate shall apply to consumers of electricity for lighting purposes to the extent of 50,000 units per annum.

Mexborough.—The result of the past year's working of the U.D.C. electricity undertaking is as follows. We give the figures for the previous year, with which a comparison can be made:—

For the year ended March 31st	1906	1905
Total revenue	£3,200	£3,028
Total working costs	1,210	1,319
Gross profit	1,990	1,709
Interest charges, &c.	665	590
Sinking fund	652	670
Depreciation (loss on scrapped plant)	—	675
Net profit	673	net loss 226
Capital expended	£18,936	£18,572
Units sold	264,402	274,946
Average price obtained	2·90d.	2·64d.
Maximum load recorded	175 kw.	170 kw.

Musselburgh.—An agreement has been entered into between the Council and the Musselburgh Gas Light Co. to have gas only for public lighting purposes where electric light is not at present in use, with the exception of the car route between Ship Inn and Magdalene Bridge. The agreement holds good till December, 1909.

Ossett.—Respecting the recent inquiry into the application of the T.C. for a loan of £3,500 for E.L. purposes, the L.G.B. has written stating that it finds there is no evidence of a real demand for electricity, and as the carrying out of the scheme would probably entail a considerable loss for some years, it could not grant the application without communicating with the B. of T. As a result of this step the L.G.B. declined further to consider the application at present. The B. of T. has intimated that before the revocation of the E.L. order was finally decided upon, the L.G.B. would be communicated with.

Provisional Orders.—Application is to be made for E.L. powers for the following districts as under, and the local authorities have been notified by the applicants:—

Beverley.—Messrs. Foote & Milne.
Harpenden.—The North Metropolitan E.P.D. Co.
Harwich.—Messrs. Foote & Milne, and Mr. F. J. Warden-Stevens.
Hindley.—The Lancashire Electric Power Co. The U.D.C. has decided to oppose the application.
Honiton.—The Western Electricity Corporation.
Poole.—Messrs. Foote & Milne. The T.C. has resolved to inform Messrs. Foote & Milne that the Poole Electricity Supply Co. already possesses an order.
Reigate.—The Mutual Electricity Supply Co.
St. Mellon's.—The Rhymney Valley and General Electric Supply Co.
Sudbury.—The Mutual Electricity Supply Co., and Messrs. Johnson and Phillips.
Yeovil.—The Mutual Electricity Supply Co., and The Yeovil Electric Supply Co.
Castleford.—The Electrical Distribution Co. of Yorkshire, and the Mutual Electricity Supply Co. The U.D.C. has decided to discuss the proposals of the first-named company with its representatives.
Loughton.—The Mutual Electricity Supply Co. The Council does not consent to the application.
Scunthorpe.—The Mutual Electricity Supply Co.
Shepton Mallet.—The New Rock Coal Co.
Swanage.—Messrs. Foote & Milne. The Poole Electricity Supply Co. already possesses an order for the district.
Woodford.—The National Provincial Electricity Supply Co.; the Mutual Electricity Supply Co., and Messrs. Foote & Milne.

Redditch.—Protection clauses having been conceded by the promoters of the Shropshire, Staffordshire and Worcestershire Electric Power Bill, the U.D.C. has decided to abandon its opposition.

Rhyl.—As the working of the U.D.C. electricity undertaking steadily results in a loss, which now appears to increase, a special Committee has recommended that a firm of consulting engineers be asked to report upon the concern for a fee of £50 and out-of-pocket expenses.

South Africa.—East London.—The City electrical engineer of Cape Town, and the Town electrical engineer of Durban (who were appointed by the Town Council of East London as experts in connection with the reorganisation of the generating

system for the electric light and tramways), having both approved of the scheme proposed by Mr. J. Mordey Lambe, the Council's electrical engineer, a town's meeting was held on June 7th for the purpose of sanctioning the expenditure of £50,000 in connection with the scheme. Considerable opposition was manifested at the meeting, however, and the voting on either side was about equal. A poll was then demanded by the opposing party, and will be held in due course. It is understood that a new scheme will go through in some form, the only question being as to whether a completely new station will be equipped, or the new generating station of the Harbour Board be taken over by the Council. The latter station, however, being on the opposite side of the Buffalo River to the town, presents certain difficulties in regard to laying cables under the river.

Some correspondence has passed between the Harbour Board and the Council, and the former has stated that the Government would probably object to the Board's selling energy to the town, and that dual control of the power station is inadvisable. The Board offers, however, to sell the building outright with fittings and machinery for £30,000, the T.C. to meet the Board's requirements in the matter of energy, and to agree to certain exchanges of land. A joint meeting is to be held to discuss the matter.

Cape Town.—Electrical energy for power purposes is now being supplied by the T.C. at 3d. per unit, irrespective of the time of day during which supply is taken. Connections to mains are to be made free of cost to consumers up to a distance of 100 ft., including fixing of meters.

Durban.—In regard to the paragraph "Section No. 4" in our last issue on new plant for the Natal Government Railways, Messrs. Bruce Peebles inform us that the machines referred to as motor-generators, are Peebles motor-converters constructed under the Bragstad-La Cour patents.

Sunderland.—At the meeting of the T.C. on the 11th inst., the Electricity and Lighting Committee recommended that a waste saving machine be obtained at a cost of £35; that a local electrical exhibition be held in the Town Hall, the cost not to exceed £100; that the following extra machinery be obtained at a total estimated cost of £6,600, and that the Finance Committee be requested to memorialise the L.G.B. for sanction to borrow such amount, viz.:—Fourth motor generator and requisite switchgear at Messrs. Lairg's sub-station; motor-generator and switchgear at Monkwearmouth sub-station; pump for deep well at Hylton Road station; water-softener at Hylton Road station; induced draught fan at Hylton Road station. The report was adopted.

Surbiton.—The electric lighting accounts for the year show a deficit of £741.

Truro.—No fewer than five companies have informed the T.C. of their intention to apply for prov. orders for E.L., and the whole of the applications have been referred to the E.L. Committee.

Walthamstow.—During the further hearing of the inquiry by Mr. H. R. Hooper into an application by the U.D.C. to borrow moneys for E.L. purposes, it was elicited that a sum of £1,110 had been expended on motors for hiring out purposes, without sanction from the L.G.B. It appears that, under the E.L. Act, 1882, the Council has no powers to let out motors on hire. It expended the above sum, and then asked the L.G.B. for sanction to a loan of £3,000 for the provision of such motors. The Board refused to sanction it. To get over the difficulty, the Council debited it to a loan of £5,000 received for free wiring. In regard to the neglected condition of the station, the Inspector said that there was a great deal of work to be done, and the Council must not look for profits, but must put its station into a sound condition. Mr. Spurr, the engineer, "has a very up-hill job." The clerk said, in regard to this, that the Committee had a scheme, provisionally, for putting in new plant at a cost of about £16,765. Mr. Hooper asked the result of the working of the tramways, from the date of opening, June 3rd, 1905, to March this year, and a member replied that there was a deficit of £5,300. It appears the accounts show a full year's expenditure and only nine months' receipts. The Council ran 30 cars two months for the purpose of training the men, it was stated, in reply to a question put by the Inspector. One member, however, informed Mr. Hooper that it "is only done to deceive you." For this brief note we are indebted to the *Leyton District Times*.

Wellingborough.—The R.D.C. has consented to the use of overhead wires for the E.L. and traction scheme for the district.

Whitstable.—The U.D.C. has decided to support a private company's application for a prov. order for E.L.

Worsley.—The U.D.C. has asked the Lancashire Electric Power Co. upon what terms it would be prepared to take over the E.L. order, or, in the alternative, to supply energy in bulk.

Woolwich. — The B.C. on July 12th decided to appoint an expert to investigate and report upon the electricity undertaking.

Yarmouth.—The T.C. has decided to allow consumers of 10,000 units a special discount of 10 per cent.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramways accounts for the year ended May 31st last have just been issued, together with a report by Mr. R. S. Pilcher, the general manager. The total receipts for the year amounted to £69,655, an increase of £168 as compared with the previous year. The total receipts per car-mile showed an increase from 10·46d. in 1905 to 10·95d. in 1906. The total working expenses for the year were £40,684, a decrease of £1,708. For traction purposes 2,019,515 units were used, an increase of 4,516 units over last year. The units used per car-mile were 1,306 compared with 1,246, an increase of 5 per cent., the total value of the increase being £467. The number of top-deck covered cars in use was 27, an increase of four during the year. During the past year the Tramways Committee sanctioned the building of six top-deck covers, and when they are finished the number of top-deck covered cars will be 29 out of a total of 69 cars. Much of the increase in the units consumed per car-mile, it is explained, is due to the extra weight and resistance to wind pressure of top-deck covered cars. The gross profit was £29,823. After appropriating for payment of interest on borrowed money, £11,061; for sinking fund, £3,134; for depreciation, £3,077; and for preliminary and Parliamentary expenses, £889; there was a net profit to put to renewal account of £11,662, as against £9,432 last year. The total car-mileage was 1,546,015; the income per car-mile, 10·95d.; the working expenses per car-mile, 6·32d; the length of the route is 14 miles 3 furlongs; and the length of the track 27 miles 5 furlongs.

Bournemouth.—Although the L.C.C. was the first authority to recommend the adoption of the conduit system of electric tramways, the system was first worked in Bournemouth, by the Corporation, and it is of interest to note that a deputation from the L.C.C. recently visited Bournemouth for the purpose of inspecting the tramways. The deputation consisted of Mr. M. Fitzmaurice, chief engineer; Mr. A. L. C. Fell, chief officer; Capt. Amphill, chairman of the Highways Committee; Mr. W. Brown, vice-chairman of the Highways Committee; and Mr. Connett, chief engineer of Messrs. J. G. White & Co. (contractors for the Bournemouth Corporation electric tramways). They were piloted over the tramways in the saloon car by Mr. H. G. Andrews, the assistant electrical engineer to the Bournemouth Corporation, accompanied by Mr. F. W. Lacey, the borough surveyor. The deputation was more particularly interested in the working of the points on the new "cross-over" on the side-slot conduit system in the Square. This is the invention of Mr. Connett, and has been tried for the first time in England by the Bournemouth Corporation, and, so far, has been worked with success. This cross-over is unique in that it is worked by points, which have been introduced for the first time on the side-slot conduit system. With this new arrangement it is possible to have as many as six or eight cars in readiness in the Square to cope with any extra traffic. The improvement also enables a breakdown or "jamming" of the plough to be dealt with more expeditiously, as a disabled car can be run on to the cross-over, and an interruption of the ordinary traffic prevented. The section was laid by Messrs. J. G. White & Co., under the direction of two of their engineers, Mr. Butler and Mr. Paddington. The deputation also inspected the generating station and central car depôt, and visited Tuckton Bridge, which crosses the River Stour, and is constructed of ferro-concrete, with ornamental ironwork.

Canada.—It is stated that the Canadian Central Electric Railway Co, which is about to be floated, proposes to construct a railway 670 miles long from Montreal through Ottawa to Orillia, with a branch to Toronto, and on to London, St. Thomas and Port Stanley.

Continental Notes.—Germany.—The West German Railway Co. is preparing plans in respect of a projected light electric railway between Solingen and Brug.

Italy.—An accident occurred last Sunday on the Rome-Frascati line. It appears that a car ran away on an incline and collided with another coming in the opposite direction. Thirty-five people were injured, and the *Tribune* correspondent says that one has since succumbed.

The State Railways Administration is considering alternative proposals for the electrification of the Giovi railway.

A conference held at Palestrina with reference to the proposed Rome-Palestrina-Frosinone electric tramway has given its support to the scheme, which, it is hoped, will be carried out soon.

A local Committee has been formed with a view to the construction of an electric tramway between Pescia, Fucecchio, Valdarno and Ponte Buggianese.—*Board of Trade Journal.*

Darlington.—Some time ago, in what has turned out a vain attempt to bring revenue up to expenditure on the municipal tramways, the Corporation, by the casting vote of the then Mayor, brought into operation a system of ½d. stages. So unsatisfactory has this proved, that demands have been made in the T.C. for a complete revision of the fares, with the object of returning to 1d. rates, and at last Friday's meeting of the Tramways Committee two reports were presented by the general manager. In the first he deals with the extension of the service to Haughton-le-Skerne, which, under the terms of the B. of T. order, must be made within the next few months unless an extension of time is obtained, and after giving figures of probable traffic, he says, "it is evident that any extension of the system would increase the loss on the

undertaking." The other report had reference to a suggestion that there should be "half fares for school children," and on this matter he expressed the opinion that it was improbable that the adoption of such a system would be to the advantage of the Light Railways Department. Statistics have been prepared on the ½d. fares question, which show that had 1d. fares been adhered to—though nearly 430,000 more passengers were carried than was likely at 1d. a head—the loss on last year's working would have been reduced by £665, or nearly 1d. in the £ on the rates.

The statement of accounts for the year ended March 31st shows a net loss of £1,031.

Dewsbury-Ossett.—At a conference recently between Dewsbury and Ossett T.C.'s and the Soothill Nether U.D.C., it was decided that the National Electric Construction Co. should construct and work the proposed tramways between Dewsbury and Ossett.

East London Railway.—The report of this railway for the past half-year says:—"Passenger traffic continues to be adversely affected, owing partly to the withdrawal of the Metropolitan District Co.'s trains, and partly to the severe competition of the London County Council tramway services *vid* New Cross to Westminster and Blackfriars at low fares."

Gainsborough.—The Light Railway Commissioners on July 12th refused the application of the promoters of the light railway scheme from the Great Northern station to Walkerith for an order to construct tramways for a distance of 4 miles 1 furlong. The local authorities opposed the application.

Glasgow.—The tramway extension from the present terminus at Possilpark to Lambhill was to be opened for traffic on the 11th inst. The distance is a little over one mile.

Halifax.—The Halifax Coroner, on the 11th inst., conducted an inquiry into the death of the two men killed in the tramway disaster on the 1st inst.

Evidence showed that the rails were greasy, as the result of a slight shower. Neither the driver nor the conductor, however, claimed that worse conditions prevailed than had been experienced on previous occasions.

The brakes, after the accident, were found tightly pressed to the wheels, but in thorough working order. To confirm this, the car had been twice, since the disaster, driven down a steeper incline—that of Salterhebble Hill, at what was estimated to be a speed of 20 miles an hour, the occupants on the first occasion including the chairman of the Tramways Committee, and on the other the tramways manager (Mr. F. Spencer), Mr. J. C. Couper (traffic superintendent), and Lieut.-Col. Druitt (B. of T. Inspector). In each instance the car was readily pulled up by means of the brakes.

Mr. John Waugh, engineer, of Bradford, and the tramways manager, expressed the view that when the wheels of the car began to skid the driver should have released the brakes and reapplied them. He appeared, however, to have screwed them tighter, thereby completely locking them. The two witnesses were agreed that, had the wheels been free, the car would have rounded the curve on to the North Bridge in safety.

Mr. Waugh said he considered that the Halifax electric brake was better than the magnetic brake in use in Huddersfield.

Theodore Chadwick, the driver, in his evidence, claimed that he did release the brakes when skidding occurred. It was suggested to him, in cross-examination, that the state of the brakes after the accident negatived that. The explanation he gave in reply was that, as the car was going over, he had to clutch at the hand brake in order to save himself, and probably brought about the locking in that way.

The jury returned the simple verdict "Accidental death," without rider or recommendation.—*Leeds Mercury.*

Harlesden.—The cars for the Harlesden section of the Middlesex Electric Tramways have been delivered, and the line will probably be open by the end of the month.

Huddersfield.—The working of the Honley section of the Corporation tramways shows an estimated net surplus of about £1,000 for the past year.

Jarrow-on-Tyne.—The B. of T. recently informed the T.C. that no formal application had been received for powers to abandon the Albert Road section of the electric tramways being constructed in the borough. With the communication was the copy of a letter from the promoters of the Jarrow and South Shields light railways to the B. of T. It stated that about one-third of the track had been laid, the overhead work was well in hand, the double-deck cars had been ordered, and it was expected that the line would be ready for working by the end of August. In due course it was again proposed to apply to the B. of T. for the abandonment of the Albert Road section and the junctions therewith. It had already been made perfectly clear to the Corporation of Jarrow that the B.E.T. Co. could not proceed with the works unless they were allowed to eliminate this section. The reasons for this had been stated before, and were briefly, that the section could not be worked by means of double-deck cars which were essential, except by the company incurring considerable expense in lowering the road under the railway bridge—an expense that was not warranted now that the Jarrow and South Shields light railways were to be worked as a separate undertaking, and not, as was contemplated at the time of their promotion, in conjunction with the tramways in South Shields, and as a through route to Gateshead to be worked in connection with the Gateshead tramways. The route was not now practicable in consequence of the Parliamentary decisions which had been made in connection with tramways crossing railways on the same level, and also by reason of the municipalisation of the South Shields tramways. Therefore the whole reason for the Albert Road section had disappeared, and the commercial value of the Jarrow and South Shields light railways had been seriously affected, and the construction of the light railways, even without the Albert Road section, was highly speculative. In order to show the company's *bona fides* in the matter, they were proceeding with the reduced scheme so as to provide travelling facilities between Jarrow and South Shields, but they would not be justified in going on with these works if the construction of the Albert Road section, which was not now needed, were insisted upon. It was moved that the B. of T. be asked not to sanction the running of the cars unless the Albert Road section were included. The Mayor (Mr. Malcolm Dillon) thought such a resolution would be ineffective. When he and the town clerk attended at the B. of T. they were informed that the Corporation could not compel the company to go on with the Albert Road route, and as to preventing the company running on the other part of the route because of the non-completion of the former section, the Board said there was no precedent for prohibiting the use of No. 1 section. After some further discussion the motion was adopted.

Lastingham and Rosedale.—The Light Railway Co. has asked the B. of T. to grant another year's extension of time for carrying out the Light Railways Order, 1903.

Leyton.—The Electric Light Committee is considering the question of running powers for its new electric trams over the West Ham and Walthamstow tramways.

London.—Paddington.—The General Purposes Committee of the B.C. does not approve of the proposal that the L.C.C. should seek Parliamentary powers to run motor-omnibuses as feeders to its tramway system generally.

Battersea.—Tradesmen in the district have decided to forward to the L.C.C. a protest against the obstruction to business by delay in the electrification works on the tramways. They point out that the work has been in operation six months, and add that some business have been ruined because of the delay.

Speed Fines.—At Tower Bridge Court on Saturday last several drivers of motor-omnibuses and electric tramcars were summoned, before Mr. Rose, by the police for driving at excessive speed in Waterloo Road. Two constables in the L Division have been provided with stop watches, and a furlong in Waterloo Road has been measured. The result was that the defendants were detected travelling at a speed of between 15 and 16 miles an hour, when only 8 miles was the limit allowed. In imposing penalties of 8s. and 2s. costs, the magistrate remarked that he did not fix such large penalties as were generally imposed upon the owners of motor-cars who were summoned for driving at excessive speed, because the defendants were poor men. If the offence was repeated the penalties would be largely increased.

L.C.C.—An expenditure of over £20,000 is recommended in connection with the construction of tramways between Hammersmith and Putney.

On Sunday night a Council tramcar ran into a motor-omnibus near the junction of St. George's and Westminster Bridge roads. Passengers on the 'bus were more or less injured and suffered from shock.

According to the daily Press, another collision took place near the same place on the same day between two tramcars. The front part of one was considerably damaged, and the line was blocked for nearly two hours.

The Royal Assent has been given to the L.C.C. Tramways and Improvements Bill, which includes the scheme for the construction of tramways over Westminster Bridge and along the Embankment to meet the proposed tramway over the widened Blackfriars Bridge. The City Corporation proposes to widen Blackfriars Bridge at its own expense.

A statement, remarkable in more ways than one, of the financial results of the working of the L.C.C. tramway system was issued last week. The following table is given, showing the "profits" on the southern tramways since their purchase by the L.C.C.:—

	Surplus on working.	Charges against surplus.	Balance.
January 1st to March 31st, 1899..	£14,958	£11,885	£3,073 surplus
1899-1900	97,940	46,166	51,774 ,,
1900-1901	75,680	61,355	14,325 ,,
1901-1902	65,234	56,172	9,062 ,,
1902-1903	62,455	64,706	2,251 deficiency
1903-1904	97,349	105,633	8,284 ,,
1904-1905	206,780	199,725	7,055 surplus
1905-1906 (partly estimated)	218,000	214,000	4,000 ,,
1906-1907 (estimated)	298,000	246,900	51,100 ,,

It will be noticed that the profits continuously diminished from 1899-1900 to 1903-4, and have remained practically nil ever since—for the depreciation and reserve allowance admitted by the L.C.C. to be necessary has not been set aside; had it been paid, the last two surpluses shown would have been more than swallowed up. The estimate for the profits for the current year is interesting.

The total outlay incurred or in prospect is £11,000,000; of this £4,800,000 has been spent, and £600,000 repaid. From the

northern system, leased to a company, the L.C.C. received in all £314,337; from the southern system £84,348 up to March last. The net surplus, after making necessary deductions, was £326,581, of which £293,592 was applied to the relief of rates. It will be observed that practically the whole of the real profit has been derived from the lease of the northern system.

A further table compares the L.C.C. southern tramways with the London United Tramways and the Central London Railway. The last-mentioned comparison is absurd, for the railway and the tram-

	L.C.C. Southern Tramways. Year to Mar. 31, 1905.	London United Tramways Co. Year to Dec. 31, 1904.
Capital expended	£2,623,692	£2,905,095
Profit on working	£203,519	£120,874
Percentage of profit to capital expended	7·6 per cent.	4·1 per cent.
Amount of reserve and depreciation funds	£66,600	£5,000
Suspense accounts included in assets	£24,510	—
Number of passengers carried	164,818,560	48,126,727
Average fare per passenger	·97d.	1·47d. approx.

way have no features in common. As for the comparison with the L.U.T., which we reprint, we may point out that the percentage profit claimed for the L.C.C. tramways is nearly twice that of the company, a striking refutation of the charge of greed invariably brought against private enterprise. Working in a far less favourable district, the company carries less than one-third of the traffic obtained in South London; but as the company is obliged to put down the actual capital expended, including that outlaid on the street improvements forced upon it by the local authorities, its capital account is greater than that of the Council, which charges huge sums in respect of similar improvements to other accounts. The comparison is, therefore, fallacious.

Maidstone.—The Electricity and Light Railways Committee has decided to recommend the T.C. to adopt the Mill Street, Knightrider Street and Upper Stone Street route for the extension of the tramway system, in preference to the Gabriel's Hill and Lower Stone Street route, on the question of expense. The probable gross cost of the latter route is given at from £13,000 to £14,000, of which some £2,000 would be regained, it is estimated, by the re-sale of properties purchased by the Corporation in the first instance. It is possible, however, that these figures will undergo some reduction.

Manchester.—On the 16th inst. Mr. G. R. Askwith, of the B. of T., conducted an arbitration at the Town Hall into an application of the Manchester tramway men for improved conditions of service. The principal point related to the question of Sunday pay. The case of the men was put forward by Mr. G. T. Jackson, the secretary of the Tramway Men's Union; and Mr. McElroy, the general manager, gave evidence on behalf of the Committee. The proceedings were conducted in private.

Ramsbottom.—The U.D.C. has decided to apply to the B. of T. for an extension of time for carrying out the Tramways Order, 1903.

Sleaford.—The Light Railway Commissioners on Friday decided to grant the application made by Messrs. A. L. Jessopp and S. V. Hotchkin for an order to construct a light railway from Sleaford to Kirkstead. The line will be 15 miles long.

Swindon.—At the inquiry into the recent accident at Swindon, Mr. J. G. Griffin, in giving evidence, said three cars of the type similar to the one which met with the accident were made by the Brush Co. The brakes of the first seven cars were of the Westinghouse magnetic type. The specified weight which the cars of the last pattern were supposed to carry was about 4 tons. The week before the accident No. 11 car was tested with a load of 5½ tons and six passengers. It stood the test, and there was a good deal of brake-power to spare. That test was taken on the most severe gradient between Prospect and the bottom of Victoria Road. The total weight of the car, unloaded, was about 9¼ tons. The worst gradient in the town was 1 in 14. The specifications of the cars stipulated that they should be held up on a gradient of 1 in 11 by both hand and magnetic brakes. He did not think the car had skidded down the hill. He considered the hand-brake would have been sufficient if worked properly. Mr. Griffin did not agree with Lyons, the driver, that the magnetic brake had gone wrong. He was certain the magnetic brake was in working order when coming down the hill.

Mr. T. Medcalf, traffic manager, said that he gave instructions to the fitter to adjust the brakes of the car, if necessary, before it descended the hill.

Mr. Ernest Lacey, consulting electrical engineer to the Corporation, gave it as his opinion that the overturning of the car was not due to the number of passengers upon it, but to the speed at which it took the curve.

Mr. Augustus Trube, of Manchester, manager of the tramcar department of the Westinghouse Brake Co., explained the working of the brakes. The result of his examination was that, owing to an excess of clearance between the brake blocks and the rocking lever, the brake would not respond to the driver's application of the magnetic brake. He considered Driver Lyons's belief that the brake blocks failed to act an error of judgment.

After deliberating for three hours, the jury brought in a verdict of "Accidental death." They added a rider exonerating Driver Lyons from all blame, and said Mr. Griffin was lacking in judgment in not sending the car to the shed. They considered that the brakes were not in perfect working condition when the car left the top of the hill, and that there had been general slackness on the part of the Tramway Committee and Corporation officials in not enforcing their by-laws.

Swinton and Pendlebury.—The U.D.C. has applied to the B. of T. for a loan of £24,317 for the purchase of the Pendleton tramway depôt, which will be repaid by Salford T.C., which has leased the undertaking.

Yardley.—The U.D.C. has abandoned the negotiations for the purchase of that part of the undertaking of the City of Birmingham Tramways Co. which is in its district. The Council offered to give £50,000, but the company refused to accept anything lower than £80,000.

TELEGRAPH and TELEPHONE NOTES.

Empire Cables.—At the recent congress of Chambers of Commerce of the Empire, a resolution was passed in favour of the dissemination of news to and from all parts of the British Empire through entirely Imperial channels. It was also resolved that the Imperial Government should be asked to assist the Colonies in providing an All-British and reliable means of cable communication with and between the West Indian Colonies.

South Africa.—The Durban T.C., with a view to popularising the telephone, has decided to circularise all private residents, to ascertain how many would be connected if a charge of £5 per annum, plus 1d. per call, were adopted.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Cayenne-Pinheiro	Aug. 18, 1902	
Port Arthur-Chifu (Closed)	Mar. 7, 1904	
Tarifa-Tangier	Jan. 18, 1904	
Garachico (Tenerif)-Santa Cruz	July 12, 1906	
Landlines.		
Puerto-Barrios	Aug. 28, 1902	
Bachkale-Deliman	Feb. 12, 1906	
Trebizonde-Batoum	July 15, 1906	
Bagdad-Bassorah	July 17, 1906	

United States.—Extensive experiments on the use of telephonic communication with moving trains are being made at Chicago in connection with the electric block signalling systems.

From the 1st inst. rates for calls from public stations in New York have been reduced, and a zone system of charging put in force, three zones having been mapped out.

Wireless Telegraphy.—Communication has been established by the Marconi Co. between Queenscliff (Victoria) and Devonport (Tasmania).

The Lodge-Muirhead installation erected at Heysham Harbour by the Midland Railway Co. has been successfully used for communicating continuously with the turbine steamer *Londonderry*, plying between Heysham and Belfast.

A return has been issued as a Parliamentary paper [197], detailing applications for licences under the Wireless Telegraphy Act, 1904, showing how each application has been dealt with, and statistics of messages to and from ships at sea, exchanged between the Post Office and the Marconi Co. during the quarters from January, 1905, to March, 1906. The total number of applications under the heads commercial, private, and experimental, is 130. Of these, six applications are still under consideration, 14 have not been proceeded with, and six have been refused. The Post Office revenue in respect of messages to ships, through its agreement with the Marconi Co., for the last quarter was £4 12s. 6½d.; for messages received from ships £104 14s. 4d. During this quarter 128 messages have been sent and 2,452 received.—*The Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—According to the *Australian Mining Standard* tenders are invited as below:—

South Australia.—September 12th. Sundry telephone materials.

New South Wales.—October 24th. Postmaster-General's department. Five sections common battery switchboard and 500 telephones.

Queensland.—August 27th. Postmaster-General's department. 21½ tons copper wire, 200-lb., H.D.; 4,700 copper tapes for 200-lb. wire; 4,700 copper binders for 200-lb. wire; 600 McIntyre sleeves; 5,350 insulators, Acme; 2,386 bolts for arms.

October 24th. Five sections common battery switchboard and 500 telephones.

Victoria.—August 7th. Postmaster-General's department. Supply 20,000 Western Union pattern double-shed single-groove glass insulators and 5,000 double-groove glass insulators.

Beckenham.—July 23rd. Electric wiring of houses for the U.D.C. See "Official Notices" July 6th.

Belgium.—July 30th. The Belgian Direction Generale des Ponts et Chaussées, 8, Rue de Louvain, Brussels, is inviting tenders until the 30th inst. for an installation of electric lighting in the Cour d'Appel at the Palais de Justice, Brussels.

Bolton.—August 9th. Two Lancashire boilers for the electricity department. See "Official Notices" to-day.

Darlington.—July 31st. Uniforms for tramway employés. See "Official Notices" to-day.

France.—July 27th. The French Post and Telegraph authorities are inviting tenders until the 27th inst. for the supply of 28 lots of paper-insulated electric cables. Particulars may be obtained from, and tenders are to be sent to, Le Sous Secretariat d'Etat des Postes et des Télégraphes, 103, Rue de Grenelle, Paris.

France.—July 27th. The municipal authorities of Lille are inviting tenders until the 27th inst. for an installation of electric lighting in the Bibliothèque Universitaire.

Hackney.—July 26th. Arc lamps and arc lamp pillars, switch pillars, &c., for the Council. See "Official Notices" June 29th.

Leeds.—August 15th. Steam and other piping for the electricity department. See "Official Notices" to-day.

London.—City.—The City Police Sub-Committee will shortly invite tenders for the supply of electric ambulances.

Newport.—July 27th. Coal and stores for the electricity department.

Rotterdam.—July 26th. The Commercial Intelligence Branch of the B. of T. is informed by the Acting British Consul at Rotterdam that tenders are wanted by the Colonial Office at the Hague for 8,200 iron telegraph poles (light), and for 700 iron telegraph poles (heavy). Particulars can be obtained from Mr. M. Nijhoff, the Hague, at a cost of one florin (1s. 8d.) in respect of each contract.

Roumania.—August 3rd. The municipal authorities of Roman are inviting tenders until August 3rd for the concession for the electric lighting of the town.

Shanghai.—July 31st. Two 600-KW. steam turbo-dynamos or steam dynamos, condensing plant, motor-generator, switchboard, water-tube boilers, &c., for the Municipal Council. See "Official Notices" July 13th.

Spain.—The municipal authorities of Garganda de Bejar (Caceras province) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Stoke-upon-Trent.—August 4th. Water-tube boiler for the electricity Committee. See "Official Notices" to-day.

Sunderland.—July 27th. Two 250-KW. synchronous motor-generators, and high and low tension switchgear, for the Corporation. See "Official Notices" July 6th.

Sutton.—August 1st. The Metropolitan Asylums Board is inviting tenders for an electric lighting installation at the Downs School, Banstead Road. See "Official Notices" to-day.

Warrington.—July 30th. Telescopic ladder tower, also overhead wire reel wagon, for the Warrington tramways department. See two "Official Notices" July 13th.

CLOSED.

Bolton.—The Tramways Committee has accepted the tender of the British Thomson-Houston Co. for ten cars.

Bradford.—The T.C. has accepted the tender of the Bradford Electrical Engineering Co. for the installation of the E.I. at the Hanson Secondary Schools.

Brush Contracts.—The following contracts have been obtained by the Brush Electrical Engineering Co., Ltd.:—

For Port Elizabeth.—One 400-KW. turbo-alternator.
For the Birmingham & Midland Tramways Co.—Three 50-KW. transformers, one 5-KW. transformer.
For the County of Durham E.P.S. Co.—One 1,000-KW. turbo-alternator.

Natal.—Messrs. Hubert Davies & Spain, as contractors to the Natal Government Railways, have placed with Messrs. Bruce Peebles & Co., Ltd., an order for three 300-KW. motor-converters, converting 6,000 volts, 50-period, three-phase current to 550 volts D.C.

North Metropolitan Electric Supply Co.—This company has placed an order with Messrs. Bruce Peebles & Co., Ltd., for a 300-KW. 50-period motor-converter, constructed under the Peebles-La Cour patents. This machine will be directly connected to the 10,000-volt mains of the North Metropolitan Co. without transformers.

London.—Bermondsey.—The B.C. has received the following tenders for arc lamp lowering gear:—

Improved Electric Supplies, Ltd.		£314
Johnson & Phillips	(accepted)	451
Prestwich & Burt		504
Veritys, Ltd.		510
London Electric Firm		525
Reason Manufacturing Co.		559
Gilbert Arc Lamp Co.		586
Marples, Leach & Co.		641
North-Western Electric Appliances Co.		646
General Electric Co.		696
Gilbert Arc Lamp Co.		727
Crompton & Co.		754
R. Easton & Son		1,702

The Council has accepted the tender of Mr. C. Franklin for the supply of Welsh coal (Bwllfa) for the electricity undertaking, at 20s. 2d. per ton, delivered at the works. 29 tenders were received.

Stepney.—The B.C. has received the following tenders:—

Arc Lamps and Columns.

Improved Electric Supplies, Ltd.	(accepted)	£1,327
Lucy & Co.		1,351
Reason Manufacturing Co.		1,359
Johnson & Phillips		1,382
British Electric Equipment Co.		1,653

Three other tenders were sent in, but were informal.

72 Boiler Tubes.

	Per foot.	Total.
British Mannesmann Tube Co. (accepted)	1s. 2d.	£75 12s.
Stewarts & Lloyds	1s. 10d.	£118 16s.
Babcock & Wilcox	1s. 3d.	£81 4s.

Poplar.—The B.C. on the 12th inst. finally decided upon the tenders for the coal conveying plant for the generating station, which have been under consideration for some time. The tenders originally received were as follows:—

	(1)	(2)	(3)	(4)
Wantage Engineering Co.	£3,175			
Graham, Morton & Co.	2,635			
G. Fletcher & Co.	2,530			
Spencer & Co.	2,462	£1,878		
Babcock & Wilcox	2,175	2,154	£2,107	£2,084
Pierson & Co.	1,981			
Head, Wrightson & Co.	1,950			
New Conveyor Co.	1,872	1,410		
Jenkins & Co.	1,863			
Gibbons Bros.	1,633	1,581	1,507	1,432
Lowca Engineering Co.	1,505			
Saml. Cutler & Sons	1,459	1,267		
Edgar Allen & Co.	1,475	1,410		
Westwood, Wright & Brierley	1,440			
Ed. Bennis & Co.	1,410	1,240	1,187	1,129
John Hitchen & Sons	1,400			
Barry, Hendry & Co.	1,385	1,150		
Ashmore, Benson, Pease & Co.	1,360	1,123		

Six firms were selected from the above and asked to submit amended tenders, which they did as follows:—

Babcock & Wilcox	£2,158	New Conveyor Co.	£2,150
Ed. Allen & Co.	1,655	Gibbons Bros.	1,875
Ed. Bennis & Co.	1,520		

S. Cutler & Sons (original tender, £1,459) did not submit an amended tender.

The Council, upon the advice of the borough electrical engineer, has accepted the tender of Babcock & Wilcox, at £2,158.

Shoreditch.—The B.C. has received the following tenders for the annual supply of arc lamp carbons:—

General Electric Co.—(1) 13 mm. × 9 in., 24s. per 1,000 pieces; (2) 18 mm. × 11 in., 53s. 6d. per 1,000 pieces; (3) 12 mm. × 10 in., 25s. per 1,000 pieces; (4) 18 mm. × 10 in., 48s. 6d. per 1,000 pieces.
Crompton & Co.—(1), 20s. 2d.; (2), 47s. 4d.; (3), 20s. 6d.; (4), 43s. 1d.
Johnson & Phillips.—(1), 19s. 8d.; (2), 45s. 10d.; (3), 20s.; (4), 41s. 8d.
Sloan Electrical Co.—(1), 19s. 4d.; (2), 45s. 2d.; (3), 19s. 7d.; (4), 41s. 1d.
This tender was accepted.

L.C.C.—The Education Committee of the L.C.C. has received the following tenders for the supply of motor-generators and switchboards and for wiring the L.C.C. School of Building:—

General Electric Co. (accepted)	£647	Westminster Engineering Co.	£718
Electric Construction Co.	665	Witting, Eborall & Co.	812

The Highways Committee of the L.C.C. received the undernoted tenders for the delivery of (1) high-tension cables, cable troughs, &c., and (2) low-tension cables, feeder pillars, &c., required for the northern tramways:—

1.—High-Tension Cables.

Western Electric Co.	(recommended)	£35,727
Henley's Telegraph Works Co.		36,050
Siemens Bros. & Co.		36,078
Johnson & Phillips		36,103
British Insulated & Helsby Cables		36,222
St. Helens Cable and Rubber Co.		36,661
Callender's Cable & Construction Co.		37,240
W. T. Glover & Co.		37,331
Lahmeyer Electrical Co.		40,096
Kabelfabrik Actien-Gesellschaft		43,440

2.—Low-Tension Cables and Feeder Pillars.

Kabelfabrik Actien-Gesellschaft	(incomplete tender)	£22,239
Henley's Telegraph Works Co.	(recommended)	23,629
British Insulated & Helsby Cables		23,748
Johnson & Phillips		23,914
Western Electric Co.		24,004
Siemens Bros. & Co.		24,140
St. Helens Cable and Rubber Co.		24,622
Callender's Cable & Construction Co.		24,716
W. T. Glover & Co.		24,879
Lahmeyer Electrical Co.		26,023

The tenderers were asked to submit rates of change of price of cable per mile, to be added to, or deducted from, their tenders, according to the actual price of copper when the orders for the several lengths of cable are given. The variation rates quoted were practically the same in each case, and the Highways Committee thought that tenders should be accepted on that basis, the actual orders for material being given when the market appeared to be the most favourable.

(*Continued on page* 104.)

THE ARMSTRONG COLLEGE, NEWCASTLE-ON-TYNE.

The Electrical and Engineering Laboratories.

The Armstrong College (Durham University), situated in the City of Newcastle-upon-Tyne, was formally opened by King Edward VII on the 11th inst.; His Majesty also opened on the same date the fine new Royal Victoria Infirmary, which is declared to be one of the most up-to-date in the kingdom.

The occasion of the opening of the College was the completion of the new wing, which finished the original scheme that was started in 1887. The College was originally founded by the University of Durham in association with the Institute of Mining Engineers and other scientific bodies, and was entitled the Durham College of Science. The work was carried on in buildings in connection with the Mining Institute, and, after the expiry of 15 years, it was found necessary to undertake a largely extended scheme. The present site was acquired, and buildings commenced. The foundation stone was laid by the late Sir William (afterwards Lord) Armstrong. The College occupies a commanding position on the outskirts of the town adjacent to the new Royal Infirmary, and facing the fine, open expanse of moorland known as the Leazes.

The first portion of the College to be completed was the Physics-Chemical Department. Then, in 1894, the second half of the building was erected, and the wing just opened completes the scheme. The College is built in the Renaissance style, and the extension, which has been designed by Mr. W. H. Knowles, F.S.A., of Newcastle-on-Tyne, has cost between £50,000 and £60,000. Mr. R. J. Johnson was the original architect of the College, but he died before the drawings for the south-east and south-west wings were completed, and these were carried out by Mr. F. W. Rich. The laboratories of the various departments, which include the Herschell Physical Laboratory, the Johnston Laboratory (provided by the executors of the late Prof. Johnston) and the George Stephenson Laboratory are said to be amongst the finest in the country. The central gateway tower forms a permanent Victoria Jubilee Memorial, its cost having been defrayed out of the surplus of the Jubilee Exhibition, held in Newcastle in 1887, the whole of which was handed over to the College by the Executive Council of the Exhibition for that purpose.

In the new wing part the Electrical Engineering Department and the Naval Architecture Department are located. The growth of the Arts side of the College somewhat crowded the rooms in the other departments, and, therefore, it was found necessary to complete the scheme in order to find accommodation for the Administrative Offices, Library and Arts Department, and to extend the Electrical Engineering Department.

The building now forms an irregular quadrilateral. Part of the quadrangle is occupied by a large examination and lecture hall and the boiler house building. The latter contains three large experimental boilers, of the Lancashire, marine and Stirling water-tube types; these supply steam to the Engineering Department for experimental purposes, for heating the buildings and for two engines, to which reference will be made later. The Engineering and Electrical Departments have developed together, the steam and electrical plants are, of course, worked jointly, and the electrical power house is situated close to the boilers in the Engineering Department.

For the last eight years the engine room and a portion of the Stephenson Laboratory have been allotted to the heavier machine work in electrical engineering; accommodation is now found in the new wing for a considerable extension of this work, and for the various standardising laboratories. It was found impossible, owing to the restriction of land and means, to erect a new building specially for electrical engineering, and an extensive suite of rooms has, therefore, been devoted to this branch of study at the end of the new buildings and adjacent to the Engineering Laboratory. On the following pages we give some views of the College and of the Engineering Laboratories.

The Electrical Engineering suite contains seven large rooms, with a floor area of about 10,000 sq. ft. On the ground floor there is the Junior Laboratory, near to which is the Lecture Theatre. The laboratory, which is a well-lighted room, contains two sets of experimental machines, built by the British Westinghouse Co. Each set consists of four machines in line on one bed-plate, namely, a motor, a generator, a motor, and an absorbing generator, each of about 6 KW. capacity, the whole forming a very flexible arrangement. The switchboards for these sets are by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, of their well-known type, containing all the necessary starters, rheostats, and instruments for the two sets. There is also in this laboratory the central board to which leads are brought from every part of the building, and from all the experimental tables, it forming, in fact, a kind of electrical exchange. The rooms are faced with white glazed bricks.

The Lecture Theatre is capable of seating 120 students, and has the usual table fittings.

Below the Junior Laboratory are situated the alternating current and research laboratories, photographic rooms, and, in an excavated annex, a battery of secondary cells. A 4-ton lift runs from the top of the building to the bottom, for the conveyance of heavy machinery. There is also an extensive system of underground corridors which can be used for special experiments.

In the Senior Laboratory there is a motor generator of 30 K.V.A. capacity by the General Electric Co., of Schenectady. It consists of a direct-current motor, coupled to a single-phase generator of the revolving field type, the armature coils of which are so arranged that they can be coupled in series or parallel. There is also a three-phase set by Messrs. J. H. Holmes & Co., consisting of a continuous current motor and three-phase generator, mounted in line. On the same bed-plate are a three-phase induction motor, and a direct current generator, for taking up the load. There is also a belt-driven 6-KW. six-pole double-current generator, kindly presented to the College by the Sunderland Forge and Engineering Co.

On the mezzanine floor is the Standardising Laboratory, containing an Addenbrooke testing set, oscillograph, &c., a photometric room, which is 120 ft. long, provided with Wright's National Physical Laboratory form photometer benches, 12 ft. long, Harcourt's pentane standard, and Simmance-Abady and Lummer-Brodhun photometers for lamp testing. The floor space is capable of being divided into various light tight compartments by curtains.

In the Stephenson Laboratory there are two experimental machines, one of 5 KW. capacity by Messrs. J. H. Holmes and Co., and the other of 9 KW. capacity by Messrs. E. Scott and Mountain, from which direct, or one, two, or three-phase alternating current, can be obtained. These can be run together as synchronous motors, or may be independently driven from a countershaft by a 20-KW. D.C. Siemens motor. A small Wilde generator and several small single-phase and direct-current motors and generators are also installed. In the engine room are located the heavier machines. These are, first a 50-KW. direct-current Castle dynamo, rope-driven from a Robey horizontal compound engine, used for lighting the old wings; also a vertical compound high-speed set with Prof. Weighton's special valve gear, direct-coupled to a Brown-Boveri 240-volt direct-current generator, of 50 KW. output. This machine has also three slip-rings for three-phase currents. There is also a 25-KW. motor-generator set; one machine has a double armature, and is used as a 480-volt motor with the armatures in series, or a 240-volt generator with the armatures in parallel, and this is coupled to a double-current generator, giving 100 volts on the direct current side, and a single-phase or a three-phase current on the alternating side.

There are in the engine room three switchboards by Messrs. J. H. Holmes & Co. for various experimental connections, and for lighting the building. Power is also available from the mains of the Newcastle-on-Tyne and

District Lighting Co. at 100 volts alternating with a frequency of 80 cycles per second, and 480 and 240 volts direct current. This supply can be drawn upon to the extent of 300 KW. if desired.

The Electrical Engineering Laboratory will be equipped with a variety of electrical measuring instruments for instruction and research, at a total cost of about £3,500.

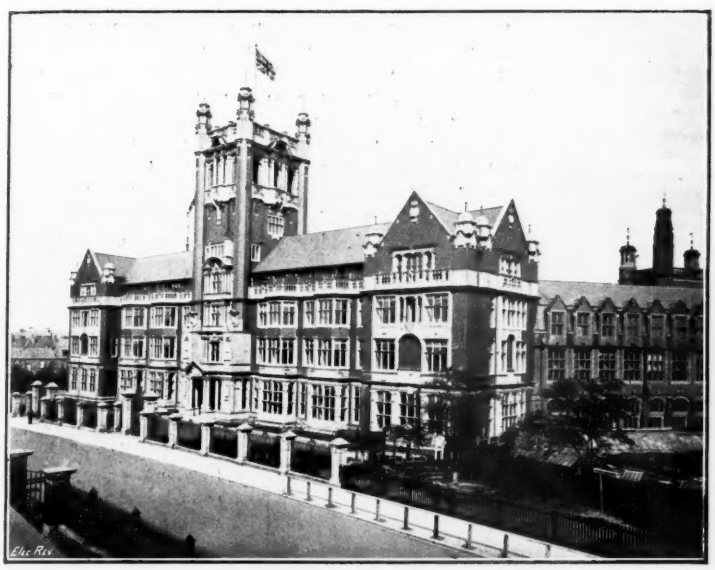

Photo. by] [*F. Macfadyen, Newcastle-on-Tyne.*

Armstrong College, Newcastle-on-Tyne: Front Elevation.

There are at present about 60 electrical engineering day students, most of whom are proceeding to the degree of B.Sc., and 300 evening students. The laboratories will accommodate some 60 day students working at the same time.

The Growth of the Electrical Department.

The Electrical Engineering Department of the College was made an independent department in 1898. The development of the laboratories was for some years restricted from lack of means, but the public subscriptions for building the new wing gave the desired opportunity of putting the equipment on a satisfactory working basis, and the increased Treasury grant released funds to form the recently created Chair of Electrical Engineering, to which Dr. Thornton, whose portrait we reproduce overleaf, was appointed.

Prof. Thornton, who has had charge of the department since its inauguration, was educated at Liverpool Institute and University College, Liverpool. He served an apprenticeship as a mechanical engineer with Messrs. Siddeley & Co., and was for some years in the drawing and estimating offices, and in charge of erecting and testing machinery in various parts of the United Kingdom. This eight years' technical and business experience has been invaluable to him later in the direction of students. Being strongly attracted by the scientific side of the problems met with in engineering practice, he left the works and entered the University College, Liverpool, as a student under Professor, now Sir, Oliver Lodge.

At this College Dr. Thornton obtained a first class in the Honours School of Physics in the examination for the degree of B.Sc., gaining the University Scholarship for post graduate study, and was bracketed first in the Electrotechnics examinations. He then took the Honours School of Engineering in one year, obtaining second class honours in the final B.Sc. examination. That year he was President of the Students' Representative Council, and an active participator in the various functions for which student life at Liverpool is becoming famous.

In 1896 he was appointed Senior Lecturer in Engineering at University College, Bristol, conducting also the classes in surveying. A research on the physical properties of ammonia gas used in refrigerating machinery was interrupted by his appointment in 1898 to the newly-formed Lectureship of Electrical Engineering at the Durham College of Science.

The growth of this department, which has been rapid, has been stimulated by the great extensions of the applications of electricity on Tyneside. Out of this activity questions have arisen from time to time, and Dr. Thornton has investigated some of those most suitably dealt with in the laboratory and the test room. Abstracts of his papers will be found in previous issues of the Electrical Review. He is a strong believer in the value of experimental investigation and research as an educative influence.

In 1903 Dr. Thornton was awarded an extra prize by the Institution of Electrical Engineers for his paper on "Synchronous Converters," and the form of voltage detector, patented by him, received one of the four prizes in the International Competition of the "Association des Industriels de France contre les accidents du travail." He is a consulting engineer with a special practice as referee, and he was chairman of the Newcastle-on-Tyne Section of the Institution of Electrical Engineers last session.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Visit of Kindred Institutions from Abroad.

(*Concluded from page* 48.)

On Thursday, July 5th, the party rendezvoused at the Wood Memorial Hall of the Institute of Mining Engineers, Newcastle-on-Tyne, and was sorted into groups, of which one went to visit Messrs. Armstrong, Whitworth & Co.'s Elswick Works, a second to the works of Messrs. J. H. Holmes & Co. and Messrs. C. A. Parsons & Co., and a third, including the ladies, to the Castle and Museum.

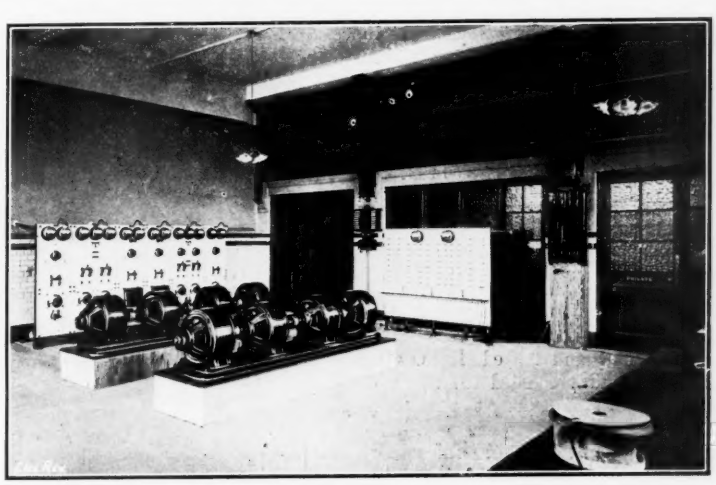

Photo. by] [*F. Macfadyen, Newcastle-on-Tyne.*

Armstrong College, Newcastle-on-Tyne: Electrical Engineering Laboratory.

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Photo. by] [F. Macfadyen, Newcastle-on-Tyne.

Prof. W. M. Thornton, D.Sc., M.I.E.E.

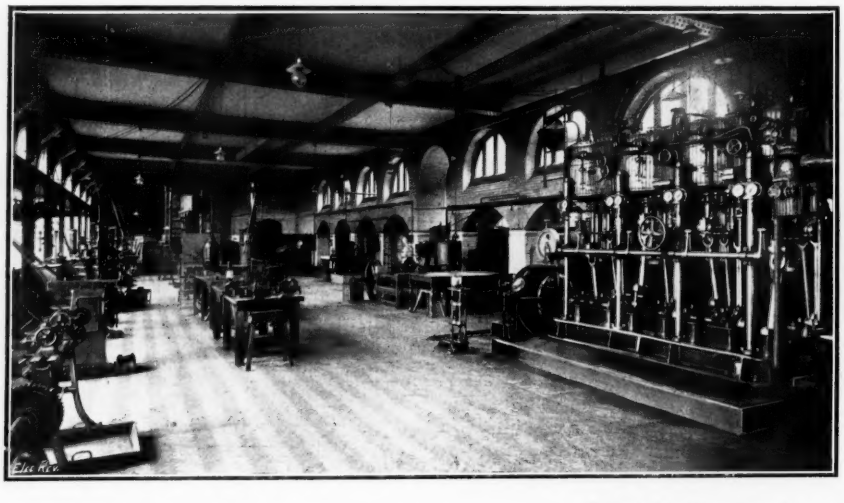
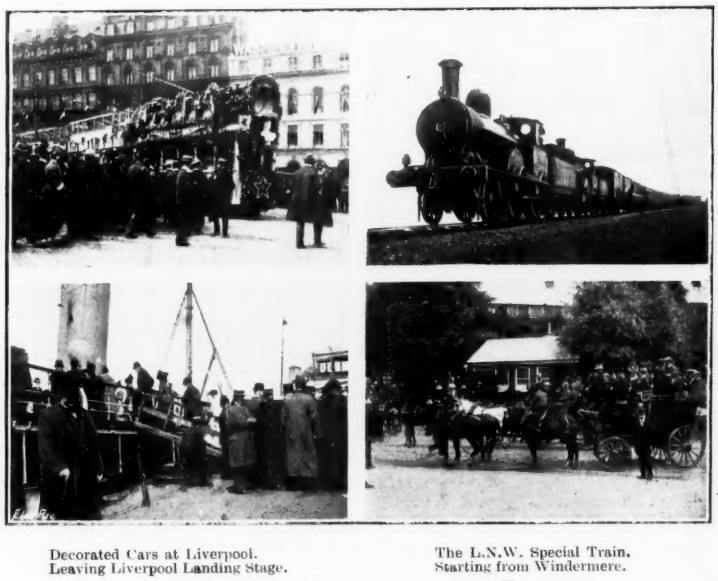


Photo. by] [F. Macfadyen, Newcastle-on-Ty

Armstrong College, Newcastle-on-Tyne: Stephenson Engineering Laboratory.

Special cars were provided for the conveyance of the two groups first named to their respective destinations. At the Elswick Works the visitors were conducted through the engine and ordnance departments, and were to have been taken through the steel works and shipyard; but there was so much to see, and the time allowed was so brief, that the tour had to be curtailed, and the party embarked on one of the Tyne Commissioners' steamers for conveyance to Wallsend, picking up the ladies' party on the way down the river.

At Messrs. J. H. Holmes & Co.'s works the visitors were received by Messrs. John and Alfred Holmes and their staff, and proceeded to inspect the various shops. Amongst the leading manufactures were the well-known Lundell motors, for making which a large number of special machines have been installed. The parts are made interchangeable, on the limit gauge system, and some ingenious devices for reducing labour and improving the product were noticed. The Holmes-Clatworthy system of motors and controllers, which has been widely adopted for driving printing machinery, and the arrangements made for rapidly testing motors on load, also attracted attention.



Decorated Cars at Liverpool. Leaving Liverpool Landing Stage.

The L.N.W. Special Train. Starting from Windermere.

The Electrical Engineers' Circular Tour.

Passing on to Messrs. Parsons's works, the visitors were keenly interested in the work passing through the shops, which were extremely busy and full. Mr. Gerald Stoney was in charge of the party, which inspected most of the workshops, test room, &c. Amongst numerous interesting features of design, we may call attention to a few points which stand out as especially noteworthy.

The "unstrippable blade" is a mechanical feature of great importance, now being largely adopted in the latest designs both by Messrs. Parsons and by their licensee, Messrs. Brown Boveri & Co. This consists of the usual form of blade supported by a recessed metal ring brazed into a side notch; this notch, however, is about ⅛ in. from the top of the blade, thus making it possible to slice this exposed top to the thinness of a piece of paper. It is claimed for this arrangement that stripping is impossible, as, if rubbing occurs, the blade simply "burrs" over, and no fracture takes place.

The extreme precautions taken to support the end connections of the A.C. armature windings were also very noticeable. Special brass castings are made after the winding is finished, to which it is firmly attached, the casting being then clamped securely to the generator frame.

Messrs. Parsons still hold to the closed slot stator for A.C. machines, which makes hand winding of the armature necessary, as they consider the various advantages, such as the solid metal (unlaminated) rotor, which may then be employed, and the better wave form obtained, &c., more than compensate for the extra labour in winding.

The self-induction becomes, of course, greater by this method, but in case of accidental short-circuit, this has the advantage of preventing an excessive rise in current and mechanical shock to the turbine.

The gravity brush-holders are still generally used, and the same method of holding the laminations in position is employed; Messrs. Parsons do not dovetail the laminations into the frame, but hold them all from turning by two steel keys.

Definite ventilation, as now entirely provided for by Messrs. Brown Boveri, is not Messrs. Parsons's standard, but

Embarking on the *Queen Alexandra*. Ascending Dunmail Raise.

On Arthur's Seat, Edinburgh. At the mouth of the Kyles of Bute.

THE ELECTRICAL ENGINEERS' CIRCULAR TOUR.

Photo. by] *[J. & R. Cooper, Glasgow.*

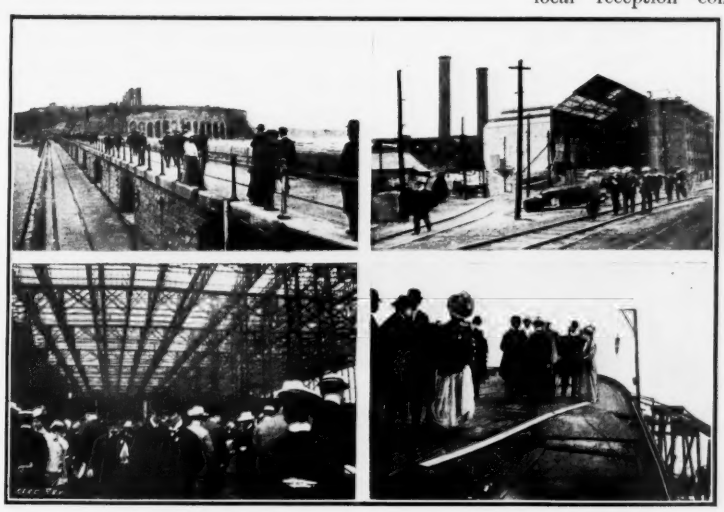
GROUP OF ELECTRICAL ENGINEERS AT PORT DUNDAS ELECTRICITY WORKS, GLASGOW.

they state that it is beginning to be asked for occasionally. This consists of entirely enclosing the generator in a solid cast-iron frame, leaving only definite openings for the incoming air and a definite opening for the outgoing air, the air being forced to take a fixed path, partly by convection and partly by fans. One advantage of this method is the possibility of piping into the generator cold air from outside the engine room. This method of ventilation was adopted, for instance, in the generators installed by the North Metropolitan Co. at Brimsdown, and is beginning to be adopted by American firms. Several large turbo-alternators in course of manufacture for the Carville power station were seen in the shops.

Leaving the Heaton Works, the party proceeded by car to Messrs. Swan, Hunter & Wigham Richardson's shipyard, where, with the other two groups, they boarded the 40,000-ton turbine ss. *Mauretania* of the Cunard Co., which is being built in one of the huge covered berths of the above-named firm. The colossal proportions of this vessel, which, it is said, is 1 ft. longer than the *Lusitania*, and will therefore be the largest in the world, excited the admiration of the visitors, who ascended to the upper deck, and explored it from stem to stern, at a height not far short of 100 ft. from the ground level. The glass-roofed shed, 740 ft. × 100 ft. × 140 ft. high, equipped with numerous electric travelling cranes in the roof, was a remarkable structure in itself, and was probably to most of the visitors a novel idea altogether. The yards are supplied with electric power from Carville, which is close by.

After this visit an adjournment was made for luncheon, which was served in the Wallsend Drill Hall, and was followed by a few short speeches. Mr. H. L. Riseley, chairman of the local section of the I.E.E., and resident engineer at Carville, presided and proposed the loyal toasts. Mr. J. Gavey explained the impossibility of organising the tour from headquarters, and praised the excellent work of the Local Sections, whose health he proposed. Herr E. Naglo also spoke, expressing the indebtedness of the visitors to the I.E.E. for the excellent arrangements that had been made; he said that if the tour lasted another week under Mr. Lloyd's organisation, they would find themselves in the vicinity of Paradise! He promised, in the name of his countrymen, to send souvenirs from Berlin to Mr. Lloyd and his colleagues, and toasted Mr. Gavey.

The President replied, and proposed a vote of thanks to the local reception committees, to which Mr. Riseley responded, expressing their pleasure in doing the work of preparation, and



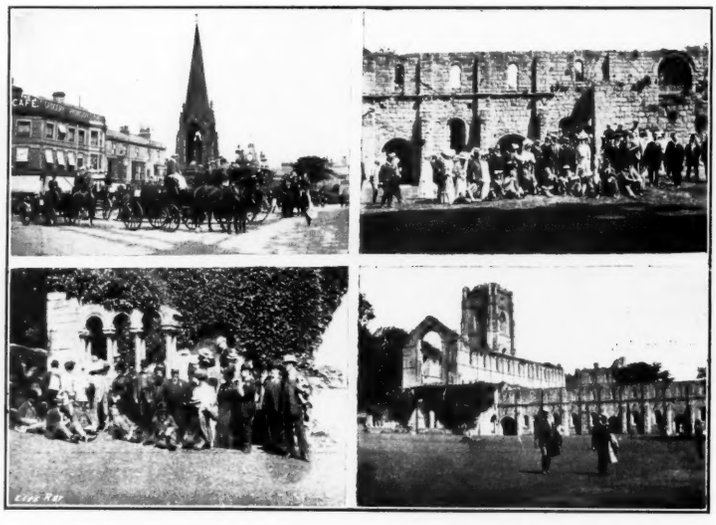
Arriving at Tynemouth. Glass-roofed shipbuilding berth, Wallsend.

Leaving Carville Power Station. On the stern of the *Mauretania*.

THE ELECTRICAL ENGINEERS' CIRCULAR TOUR.

thanking the manufacturers who had kindly thrown open their works for inspection.

The next visit was to Carville Power Station of the Newcastle Electric Supply Co. This was really one of the most interesting of all, for here was seen the biggest, and perhaps the best, example of the generation of electricity by steam power on a large scale for distribution to industrial concerns. The present equipment consists of four Parsons turbo-alternators, aggregating 20,000 H.P., and four more of 7,000 H.P. each are being installed. As all these sets can deal with overloads of 100 per cent. without difficulty, the effective capacity of the plant is much greater than the nominal. It was noticeable that air-shafts had been fixed on some of the generators, directing the hot air upwards and discharging it at a height of 15 or 20 ft. above the floor level. The condensing plant is situated below the floor, in open wells accessible to the crane. The "unit" system has been adopted, with boilers of the Babcock & Wilcox marine type and of the Stirling type: it was observed, in connection with the latter, that thermal storage tanks were being installed. The company's field of operations covers 625 square miles, and already the demand amounts to 53,000 H.P. Transmission lines working at 20,000 volts and 40 miles in length, are being laid down in Durham, the intention being, we believe, to generate the whole of the energy required at Carville, the Neptune Bank plant being used only on peak load and on Sundays. The construction of the power station—largely of galvanised iron and steel framework — showed a striking contrast with the elaborate architecture of some of the municipal works previously visited; but then, Carville is run on strictly commercial lines, and can supply energy at, we believe, less than ½d. per unit. It is exceedingly interesting to note that the Castner-Kellner Alkali Co. are now erecting new works close by, and will take about 24 million units per annum, working day and night; thus cheap power attracts industry here as at Niagara. Mr. C. Merz is the consulting engineer, and Mr. R. P. Sloan general manager.



Starting from Harrogate. The Italian Engineers at Fountains Abbey. Group of Visitors at Fountains Abbey. View of the Abbey.

THE ELECTRICAL ENGINEERS' CIRCULAR TOUR.

From Carville the visitors proceeded by steamer to the works of the Wallsend Slipway and Engineering Co., to see the huge Parsons turbines which are there being built for the *Mauretania*. These engines, consisting of two high-pressure and two low-pressure turbines, will jointly develop about 70,000 H.P., and will propel the ship at a speed of 25 knots. We look forward to the day when turbines of this size will be used to drive electric generators. Most

Photo. by] [*J. & R. Couper, Glasgow.*

ELECTRICAL ENGINEERS AT PORT DUNDAS ELECTRICITY WORKS, GLASGOW.

of the parts visible consisted of huge iron castings for the stators, which were being grooved and faced.

Re-embarking on the *J. C. Stevenson*, the visitors were taken past the busy yards and engine works of Tyneside to the mouth of the Tyne; on the way a good view was obtained of the aerial electric rope-way of Messrs. Palmer's shipyard, which has proved highly successful, and is being duplicated. After steaming round the end of the new pier, to look at the ruins of the old one, the party landed and partook of light refreshments at the Bath Hotel. Afterwards the visitors dispersed to explore the amenities of Tynemouth and Whitley, and to return to Newcastle by the electric trains of the North-Eastern Railway when this occupation palled upon them.

On Friday morning the party left Newcastle for Leeds, where they arrived at midday. They were received by the Lord Mayor and the Electric Lighting and Tramways Committees at the Art Gallery, and were entertained at luncheon in the Town Hall. After the usual toasts, the Lord Mayor proposed "The Visitors," who, he supposed, had come to pick the brains of British electrical engineers, but whether there was much to pick he did not know. They had always been told that they were lagging behind, as long as he could remember, but they got along somehow. Mr. Gavey responded, expressing the thanks of the visitors for the generous hospitality of the city, which, with that of other municipalities, had helped to promote international friendship. On Tyneside particularly, he remarked, the vast progress of electricity supply was exemplified by the confidence of the great shipbuilding and engineering firms in its capabilities. Prof. Farny also replied, complimenting the secretary and assistant secretary on their work, and joining in thanks to the city.

Mr. R. Hammond proposed "The Electricity and Tramways Committees" in his characteristic manner, and recalled the days when he promoted a company to supply electricity in Leeds. Alderman Matheson, chairman of the Electricity Committee, and Sir John Ward, chairman of the Tramways Committee, responded, the latter chaffing the former on the subject of profits, which are forthcoming in the Tramways Department, but not, apparently, in the other.

Mr. Patchell expressed the indebtedness of the visitors to the hearty assistance of the municipalities, which had made the tour like a royal progress. Proposing the health of the Lord Mayor, he whetted the interest of his hearers by a reference to municipal trading, but immediately turned to "municipal co-operation," without which the visit would have been impossible. The Lord Mayor briefly replied, and the visitors dispersed—some to Roundhay Park with the ladies, others to the lighting and tramway power stations, and others to the works of Messrs. Greenwood & Batley, Messrs. Kitson & Co., and Messrs. Joshua Buckton & Co. At the electricity supply station Mr. Hammond, with Mr. Dickinson, the city electrical engineer, conducted the visitors through the old and new works, where the old rope-driven sets contrasted sharply with the modern vertical high-speed direct coupled steam alternators. The tramway plant, consisting of low-speed horizontal compound engines with heavy fly-wheels, driving direct 750-KW. dynamos, naturally looked more imposing than the lighting vertical sets, though the latter were really of twice the output. Mr. J. Burbridge is the resident engineer for the tramways.

At Messrs. Greenwood & Batley's, besides the well-known Delaval steam turbine, the manufacture of torpedoes was a most interesting feature, and a great variety of other specialised manufactures was to be seen.

Great interest was taken in the beautiful mechanical work done by the skilled employés of this company, especially in the operation of cutting the gear wheels, which give the 10 to 1 ratio used between the speeds of the steam turbine and of the two D.C. generators, which form one steam dynamo unit as built by this company.

Very little change in the wheel and blade construction has been lately made. The steel wheel is first cut out and the rim slotted and recessed, the blades being then inserted separately and the surfaces finished off. The workmanship is so fine that in many cases it is difficult to detect with the naked eye that the blades are not all cut from one piece.

It is of interest to note that this company has lately received an order for two 1,000-KW. De Laval turbo-generator sets, which will be the largest ever yet built. In these sets the standard method of geared shafting will be departed from, and it is stated that the generators will be direct coupled to the turbines, and will operate at a speed of 1,500 r.p.m.

Messrs. J. Buckton & Co. are world-famous for their machine tools, and their works were of special interest to electrical engineers on account of the complete system of electric driving adopted. At Messrs. Kitson's works also this was the case; the work done here consists largely of locomotive and stationary engine building, and similar heavy work.

In the evening a conversazione was held at the University by the Pro-Chancellor, Mr. A. G. Lupton, and the visitors found the equipment of the laboratories of more than ordinary interest—indeed, some of them were enthusiastic on this score, especially regarding the apparatus provided for technical instruction.

Saturday, July 7th, was the last day of the tour; most of the visitors left Leeds at 9 a.m., but a few members of the party, unable to take the trip to Harrogate, visited the Leeds Copper Works at Thwaite Gate, Leeds, where a most interesting and enjoyable morning was spent. This firm does a large business in copper and brass pipes, and the works afford also a good example of an up-to-date copper refinery.

The copper pigs as received contain about 98·5 per cent. of pure copper, and before being placed in the electrolytic tanks must be cast into rods corresponding in length to the tanks. With this casting is also combined a refining process, the metal in the furnace being treated with nitre and lime and a piece of green wood inserted or green wood poles used for stirring the molten metal; the cast rods obtained contain about 99·5 per cent. pure copper. The slag from the first furnace contains about 40 per cent. pure copper, but is again reduced in a second and third furnace until it finally contains not more than ·4 per cent. copper.

These rods then pass to the electrolytic baths, where they are fixed on a frame below the cathodes—the liquid being copper sulphate and dilute sulphuric acid.

The cathodes consist of a number of brass cores or mandrels placed on a wood support at either end, and made to revolve by a system of interconnected cranks. On the surface of these brass cores the copper is deposited while a row of insulated brushes move up and down, smoothing the surface of the deposit.

The surface of the "mandrel" is brushed with black lead to facilitate the removal of the copper tube from the brass core.

The first bath contained 11 tubes of 2 in. internal diameter, and approximately 14 ft. long, and was stated to carry the full current given by one of the electrolytic generators, viz., 1,500 amperes.

The depositing shop covers approximately 265 ft. × 200 ft., and contains a large number of tanks arranged about 70 in series to each 110-volt, 1,500-ampere generator, all working at approximately the same current density and containing tubes varying in size from 2 in. internal diameter to 14 in.

The bath liquor during the "deposition process" becomes too rich in copper sulphate, and is afterwards boiled down and crystallised out, any excess of copper sulphate being sold as a by-product.

In the residue house, all the residue from the depositing tanks is reduced, and an average of 90 oz. of gold, and 3,000 oz. of silver per ton of residue, is obtained. These metals are sent to the silver and gold refiners, and form another valuable by-product.

The manufacture of brass pipes is also undertaken by this company, and forms a convenient way of using up their scrap copper.

The Hunslet Engine Works, and the Yorkshire Electric Power Co.'s generating station, were also open to visitors.

Arriving at Harrogate, the main party boarded coaches, and drove to Ripon, where a short stay was made to visit the Cathedral. The drive was then resumed to Studley Royal, from the gates of which the visitors walked through the beautiful gardens to Fountains Abbey, the brilliant sunshine showing off the exquisite scenery of this peaceful spot to the best advantage. Luncheon was partaken of in the cool Cellarium, after which the party drove back to Harrogate by a different route.

The Corporation of Harrogate had kindly made the visitors free of the Gardens, Kursaal, and other local attractions, and entertained them to tea in the Kursaal. A special complimentary concert was excellently performed by the municipal orchestra, in the course of which Miss E. Waddington sang to the accompaniment of Mr. G. Wilkinson, chairman of the Leeds Local Section of the I.E.E. Before the concert was quite over, the time came for departure to London by the special train, which arrived at King's Cross at about 11 P.M.

Thus ended this most successful and memorable tour. We give in the foregoing pages a few snapshots, which may serve as souvenirs of some of the places visited ; for some of these we are indebted to the courtesy of Mr. Langridge, jun. We have already briefly summarised the leading features of the tour, and have only to add our "Farewell," and "*Au revoir*" to our foreign friends.

CONTRACTS CLOSED.

(*Continued from page* 97.)

Marylebone.—The Electricity Committee has provisionally accepted the following tenders :—

C. A. Parsons & Co.—Fifth 2,000-kw. turbine set for generating station, £9,740.

Babcock & Wilcox.—Two additional boilers at generating station, £7,894.

Lancashire Dynamo Co.—Duplicate balancer booster and switchboard, £2,307.

St. Helens Cable Co.—2,500 yards of 1·5 sq. in. paper-insulated plain lead-covered cable, £2,769 17s. 9d. ; braiding and compounding same, £85 4s. 6d. ; 300 yards of ·5 ditto, £115 18s. 2d. ; braiding and compounding same, £5 9s. 1d ; 5,200 yards of 7/16s, £183 3s. 8d. ; braiding and compounding same, £23 12s. 8d ; 4,500 yards 7/20s five-core pilot, £332 7s. 8d. ; braiding and compounding same, £25 11s. 4d. ; total, £3,541 4s. 10d.

Walter Macfarlane & Co. (Glasgow).—Supply and erection of standard pillars required for the lighting of Oxford Street, £1,114.

Albion Clay Co.—Earthenware ducts required for cables to be laid in Oxford Street, 10½d. per yard.

Port Elizabeth.—The tender of Messrs. Reiners von Laer & Co. has been accepted for the re-wiring, in screwed insulated conduit, of the six-story building of the South African Mutual Life Assurance Society.

Radcliffe.—The U.D.C. has accepted the tender of the Lancashire Dynamo & Motor Co., Ltd., for electric motors on the hire-purchase system.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., for additional steam plant at the generating station.

FORTHCOMING EVENTS.

Saturday, July 21st.—At 3 p.m. Civil and Mechanical Engineers' Society. Visit to the Metropolitan Water Board's new works at Honor Oak.

Wednesday, August 1st.—British Association. Meeting at York.

NOTES.

The Metric System.—We are informed by the Decimal Association that a number of new Vice-Presidents have been elected, amongst whom we notice are Lord Rayleigh, Sir Hiram Maxim, Sir David Salomons, Sir John Jackson, Sir William Mather, Sir Andrew Noble, Sir W. D. Pearson, and Sir J. T. Brunner. A list of members of Parliament who support the aims of the Association has also come to hand, and shows a total of 355, giving a majority of 10 in the House of Commons (the Association makes it 20, but we fail to see how this figure is arrived at) in favour of the movement. An interesting fact is that the American I.E.E., when invited to vote in April last on the question of the adoption of the metric system in the United States, returned 1,569 replies in favour against 178 in opposition to the proposal. This is a striking expression of opinion. We congratulate the Association on the good progress made towards the goal ; the sooner the handicap of our present anomalous systems is removed, the better.

Electrical Nomenclature. — The Spanish Real Academia has decided to give new names to certain electrical terms in the Spanish language as follows : Unit of quantity of electricity, instead of coulomb, *culombio ;* unit of capacity, instead of farad, *faradio ;* unit of intensity, instead of ampere, *amperio ;* unit of E.M.F., instead of volt, *voltio* ; unit of resistance, instead of ohm, *ohmio.*

Electric Shock Fatalities.—It is reported that on Wednesday Daniel Williams, a mechanic, of Cumneol, Aberdare, and his son-in-law, while putting up a new engine, were killed by coming in contact with a "live" wire connected with the electric winding plant at a colliery owned by the Powell-Duffryn Colliery.

Imperial Intelligence.—Doubtless as the result of the admonition to "think Imperially," Sir Sandford Fleming has proposed the establishment of an Imperial Intelligence Department, and his proposals have been cordially welcomed by a number of distinguished persons. The proposal comprises the laying of a system of "State-owned globe-girdling cables," worked by local committees in all parts of the Empire, and used to transmit information of general interest gratis for simultaneous publication in all our great cities. The cost is estimated at £5,000,000. Ordinary messages would be transmitted at low rates during half the day.

Hoist with His Own Petard.—Our readers who remember Mr. E. Kilburn Scott, who went out from this country to Sydney University a couple of years ago, will read the following from the *Bendigo Advertiser* with relish :—"University Appointment :—Mr. Bevan, who was appearing as junior counsel for the Electric Supply Co. of Victoria, Ltd., in its appeal against the rating of the City Council, heard in the County Court yesterday, sought to throw discredit on the appointment of Mr. E. K. Scott, a witness, to the charge of the electrical department of the Sydney University. Counsel elicited the fact that the department had been established through the beneficence of Sir Peter Russell, who had donated £50,000. 'And you married Sir Peter's niece?' asked counsel. Witness paused, and appeared to hesitate about answering. 'There is surely no objection to the witness answering the question, your Honour?' appealed counsel, pursuing his point. 'I only met Lady Russell 16 months ago,' answered witness, with apparent reluctance. 'I have been married for 10 years,' he added. 'And you married Sir Peter's niece?' asked counsel, clinching the point. 'Oh, no,' replied witness in a surprised tone, and his Honour and the court laughed heartily, while witness softly remarked to counsel, 'I think someone has been pulling your leg.'"

B.T.-H. Glow Lamps.—In the report of the evidence on the Poplar inquiry in the *Daily Telegraph* of the 10th inst., page 5, the following paragraph appears :—"Mr. Oxley said he did, and proceeded to give items. In 1905 16 dozen B.T.-H. glow lamps were tendered for at 12s. 6d. per dozen, and 36 dozen were supplied, *whereas the price in the current tender was 6s. a dozen.*" While in the above it is not stated in so many words that the current tender of 6s. a dozen was for B.T.-H. glow lamps, it may be assumed to apply to the latter; this, we are informed, is decidedly wrong, as no B.T.-H. glow lamp can be bought at this price, even in large quantities. The cost of producing the B.T.-H. glow lamps absolutely precludes the possibility of their being sold at 6s. a dozen, and the B.T.-H. Co. assure us that they have never yet tendered for B.T.-H. glow lamps at 6s. a dozen.

Lift Fatality.—George Corben, 22, an electrician, while at work in the lift-well at the warehouse of Messrs. Lever Bros., at Broken Wharf, E.C., was killed by the lift weights falling upon him when the lift was set in motion. He was fitting up an electric bell at the time. The deceased had been in the employ of the contractors for the installation of the lift, and on the completion of the work he accepted the post of chief electrician, and started his duties on Monday last week. There were one or two odds and ends still to do to the lift, amongst which was the fixing of wires for electric bells up the lift shaft. According to the evidence at the inquest, the lift was fitted with patent outer doors which could only be opened from the outside, and there were two iron gates, both of which had to be shut before the current would act. On one occasion the deceased had thrown the mechanism out of gear for the purpose of working with the lift doors open, but the works foreman who saw him do it told him he must never tamper with it again in such a fashion, as they had gone to great expense to have the most up-to-date lift fitted, and had no desire that anyone should improperly use it. On the Tuesday afternoon last week deceased spoke to the manager about having the lift stopped for half an hour while he fixed the bell wire inside, and permission was given to do so. Without any warning to anyone, however, he threw the mechanism out of gear on the ground floor, and then getting into the well, started fixing the bell wire. A little latter the liftman took the lift up to the fifth floor, and the deceased apparently did not notice the descent of the heavy balancing weights, which struck him on the head. He died in a few minutes. The jury returned a verdict of "Accidental death," and added that no blame whatever attached to Messrs. Lever Bros.

Tramway Accidents and Regenerative Control.—We should think Mr. Thomas Hey is now regretting the attack of *cacoethes scribendi* which impelled him to forward that letter on the Halifax tramway accident to a Wednesday contemporary. It has provided Mr. Raworth with a long-wished for opportunity, of which he takes full advantage, for after smiting Mr. Hey hip and thigh, he leaves him without a leg to stand on.

Western Electric Pension Scheme.—The Western Electric Co., of North Woolwich, Chicago and other places, has set apart a sum of £80,000 as a pension fund for the benefit of its employés in all parts of the world. It is intended to add to the fund a sum of £30,000 yearly from the profits. In order to share in the benefits of the scheme an employé must have reached the age of 60 years, and have been 20 or more years continuously in the company's service. Employés who have become totally incapacitated after 10 years or more of continuous service may receive aid at the discretion of the Pension Board. It is noteworthy that the firm's employés are not called upon to contribute to the fund.

Some Principles of Resistance Furnace Design.—In an intermittent resister furnace the net chemical reaction is endothermic, and the resister is distinct from the material to be acted upon. The flow of electricity is limited to the resister, and the heat diffuses by conduction. If one constructs a system of isothermal surfaces, and the lines of heat conduction perpendicular to these, a clear view of the heat diffusion inside the furnace is obtained. Any chemical reaction is carried on between two limits of temperature, the minimum being that at which the reaction starts, and the maximum where decomposition sets in. Thus starting from the resister at the highest temperature, we have the "surface of productive heat diffusion." Further away is the surface of non-productive heat diffusion, beyond which no further chemical action can take place. In the intermediate zone the entire chemical action takes place, and is more or less well defined. The heat then is consumed in four different ways:—(1) To heat the material; (2) to produce a chemical reaction; (3) to superheat the product; (4) to heat the material beyond the productive zone, which, of course, is wasted. All these must be considered in the construction of a furnace. On starting such a furnace the temperature at any point is a function of time and distance from the resister until a steady condition is reached. This rate of temperature change is highest when the specific thermal conductivity of the material is greatest. The lower their density, however, the lower is their capacity for heat, and the change of temperature between successive points is increased. Taking the case of the rectangular granular resister, the isothermals are square at first but gradually become rounded off. This means that the lines of flow of heat are more divergent at the corners than along the surfaces. Hence the rate of temperature change with the time, is slower at the corners than at the sides. A high value of the rate of energy supply per unit of surface of productive heat diffusion produces high thermal efficiency, and consequently maintains a steep temperature curve. The active zone is then very efficient for heating purposes. The limit, however, is influenced by the cost of other items in many cases, or a time limit may have influence in actual practice. To sum up, a large surface of productive heat compared with non-productive heat is to be aimed at, as in the multiple resister furnace, or the zone silicon furnace with a zigzaging core. Briefly, the fundamental principle of intermittent resister furnace design is: inside the advancing zone of work approach as near as possible, and outside avoid as far as possible the state of steady flow of heat and fixed temperatures. These results applied to the various uses of furnaces indicate in a remarkable manner the best working conditions and type of furnace for any particular purpose.—C. L. Collins, in *Electro-Chemical and Metallurgical Industry*, IV, No. 6, Report Amer. Electrochem. Soc.

Municipal Trading.—Sir Felix Schuster presided at the fourth annual meeting of the Industrial Freedom League last week, and, in moving the adoption of the report, said that the League was of a non-political character and knew no party. What they advocated were principles which he believed to be sound, and which were necessary to be enforced at the present moment, when they been departed from in various directions. The principles were such as should at forthcoming elections be brought before candidates and electors. He asked those present to spare no efforts to find suit able candidates (whatever party they might belong to) who were at one with them, and whose principles were those of sound economy and sound finance, to which so much of the country's commerce and trade was due. It did not imply any hostility to municipal undertakings if they maintained, as they did, that these had been carried to excess, that there were limits which must be imposed, limits which the state of the money market imposed on borrowings for such undertakings.

Lord Avebury, who followed, regretted the present tendency to municipal trading mainly on five grounds. First, the legitimate functions and duties of our municipalities were already enough, if not, indeed, more than enough, to tax all their energies and fill up all their time. Secondly, it would involve an immense increase in municipal debt. Thirdly, it would involve municipalities in labour disputes. Fourthly, as there would not be the same stimulus to economy and attention, there would be a great probability, not to say certainty, that either there would be a loss or the service would cost more. Fifthly, it was a serious check to progress and discovery. Lord Avebury enlarged on these different points, and in the course of his arguments he said that in many cases, at any rate, the profits from municipal enterprise were imaginary. Too little was allowed for depreciation, for rent, for legal and clerical expenses. In many cases in electric lighting an undue amount was charged to street lighting; in tramways, too much was charged to street improvements. Still, taking the accounts as given, the number of electric light undertakings which had been working for 12 months was 191. The capital expenditure had been £27,000,000, on which the profit claimed was £341,000. The amount put to depreciation, however, was only 1 per cent., which was absurd; if 2½ had been allowed, which was quite a minimum, this would have amounted to £673,000, and would have turned the so-called profit into a heavy loss. Forty-eight municipalities work tramways; of these only 13 make any contribution to the rates, 17 make no depreciation allowance, and only 11 allow over 2 per cent.

Electrolytic Chromium.—A paper by Prof. Max Le Blanc is reported in *Electro-Chemical and Metallurgical Industry*, IV, No. 6, Report Amer. Electrochem. Soc. Anything from the pen of this undoubted authority on electrolytic problems is bound to have weight. The present paper deals with the patents of Placet and Bennett, who stated that chromium could be deposited from chrome alum in a massive form in the presence of alkaline sulphates acidified with sulphuric acid. Placet went so far as to exhibit 1 kg. of chromium obtained by the above process. Carveth and Mott and Carveth and Curry repeated this work, and obtained good deposits at least 0·1 mm. thick. Le Blanc, however, states definitely that chromium of any desired thickness cannot be obtained in this manner, and concludes that the essential conditions were omitted from the original specifications. The author gives the following order for the best results obtained up to the present time: Lead anode, porous cup, chromium sulphate solution containing free boric acid, copper cathode. Rotation is unnecessary, and a good deposit is obtained at first. This, however, cracks as the deposit thickens, and finally scales off. Fine deposits can be plated on brass, copper or carbon in this manner, but the greatest thickness does not exceed 0·13 mm. The 1-kg. chunk could not have been obtained in the manner described.

Motor-'Bus Accidents.—According to a statement made by the Home Secretary in the House of Commons on 10th inst., there were in June 390 accidents from motor-omnibuses in the Metropolitan Police District. Eighty of these accidents resulted in personal injury, and three proved fatal.

London Power Supply.—Commenting upon the report of the L.C.C. Highways Committee on this subject, the *Daily Chronicle* remarks:—"We feel sure that the Council will see the necessity for getting to work quickly, but it should also go to work surely, as this will be its last chance. If it relies on its own officers, who are already fully occupied with their daily duties, to prepare what will be the largest electric power scheme in the world, it will court failure. There are rumours that all the electric lighting companies in London are forming a combination, with the help of the organisers of the Administrative Company, to oppose the Council with a rival scheme."

Appointments Vacant.—Assistant master for the Science Section of the Aston Manor Education Committee (£150); clerk and commercial assistant for Acton Electricity Department (£100).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Central Station Engineers.—Mr. A. E. McKenzie, resident engineer of Stuart Street Electricity Works, Manchester, was married at St. Mary's Church, Liscard, on July 11th, to Miss Louie White, third daughter of the late Mr. Richard White, civil engineer of Widnes. The presents included a silver tray from the staff of the Manchester Corporation electricity department. The presentation was made by Mr. S. L. Pearce, city electrical engineer.

The Southampton T.C. has by 14 votes to 13 decided to defer for a year a proposed increase of salary from £190 to £210 to Mr. H. L. Mills, distribution superintendent.

Mr. Henry Hall, of Sheffield, Mr. H. Lister, of Newcastle-on-Tyne, and Mr. J. Moon, of Manchester, are the selected candidates to be interviewed by the U.D.C. for the post of electrical engineer at Scunthorpe.

Ilford U.D.C. has decided to place the tramways department under the management of Mr. A. H. Shaw, electrical engineer, and to increase his salary from £450 to £475, as from June 24th last, with a further increase of £25 next year, and a gratuity of £25 for services rendered since the resignation of Mr. Spurr.

The Electricity Committee of the Ashton-under-Lyne T.C. has recommended that the salary of Mr. Wales, chief assistant engineer at the electricity works, be increased by £25 per annum.

Mr. R. R. Edge, of the Doncaster Corporation electricity staff, who has secured an appointment at Ipswich, has been presented by the electricity and tramway staff employés with a clock.

The Woolwich T.C. has granted the following increases of salary in the electricity department:—Mr. J. W. Keats, acting electrical engineer, from £200 to £250 per annum; Mr. S. H. Penning, distribution engineer, from £150 to £180; Mr. S. P. Ives, acting installation engineer, from £109 to £140; Mr. Speight, Mr. Clare and Mr. Eley, charge engineers, from £120 to £140; Mr. T. W. Bunce, junior charge engineer, from £91 to £120; Mr. F. Kershaw, chief clerk, from £160 to £180; Mr. C. A. Trayte, draughtsman, to £100.

On July 13th, at the Horsham electricity works, Mr. W. E. Kidner, who is resigning his post at Horsham in order to take up that of chief assistant at the Leatherhead electricity works, was presented with electrically-illuminated table flower centre vases, on the occasion of his marriage.

Mr. Fredk. H. Edwards, A.M.I.E.E., is leaving the London United Tramways, Chiswick, to take up a new appointment as station engineer with the Metropolitan Borough of Woolwich.

Tramway Officials.—On July 6th a presentation was made at Wakefield to Mr. W. H. Webster, who has left to take up a position as inspector on the Burton and Ashby (Midland Railway) Light Railways. Motorman Shorrocks presided, and the presentation (a marble timepiece) was made by Inspector Shepherd, in the unavoidable absence of Mr. T. Tate, chief traffic superintendent.

Mr. G. R. Blackburn, assistant electrical engineer to the Bradford Corporation tramways, has been appointed rolling-stock superintendent to the Manchester Corporation tramways, at a salary of £300 a year.

General.—Mr. F. CHARLES RAPHAEL informs us that his new business address is 156, Temple Chambers, Temple Avenue, London, E.C.

Mr. HAYDN T. HARRISON announces that he has severed his connection with the Reason Manufacturing Co., Ltd. He is retaining his offices at 11, Victoria Street, S.W., and will carry on his business from this address as previously.

Obituary.—The funeral took place at Bradford on Saturday, of Mr. JAMES DAVIS, of the firm of Messrs. J. Davis & Co., electrical engineer, of Tyrrel Street, Bradford, who died at the age of 58 years, after a long and painful illness. He was a strong Churchman and Conservative, a keen sportsman, a Freemason who had passed through many honours, and an enthusiastic supporter of several charitable movements which had to do with the lower-class child life of the city. At the funeral a sight was seen which is unique in Bradford's records, there being present, in token of appreciation of Mr. Davis's philanthropic work, a score of newsboys and shoeblacks carrying a banner draped with crape.

An Edinburgh paper records the death of Mr. WILLIAM ALEXANDER BRYSON, who for some years was electrical engineer to Leith Corporation. Mr. Bryson went to Leith in 1897, and was responsible for the designing of the electric station and the carrying on of the work until early in 1901, when he resigned and begau a private practice as consulting engineer. Since taking up private work in Leith, he had superintended installations of lighting and power in various public buildings. Mr. Bryson was a Fellow of the Royal Society of Edinburgh, and he had devoted much time lately to the improvement of steam motor-cars.

We regret to record the death of Mr. HERBERT DREWETT, A.M.I.E.E., who was, until quite recently, a partner in the firm of Messrs. Drewett & Hood, whose business was purchased last December by Messrs. T. Hood & Co., Ltd, Mr. Drewett becoming a director of the new business. When this amalgamation took place, Mr. Drewett accepted an appointment as manager of the Bangkok Dock Co., at Bangkok, in Siam. It was from there that a cable was received, stating that he had died from cholera on July 3rd. He only left England about six months ago.

NEW COMPANIES REGISTERED.

Ruberoid Co., Ltd. (89,378).—This company was registered on July 4th, with a capital of £6,000 in £1 shares, to acquire the goods manufactured by the Standard Paint Co., of New York, and/or the Ruberoid Gesellschaft Mit Beschraenkter Haftung, of Hamburg, to sell the same in the United Kingdom or elsewhere, and to carry on the business of manufacturers of and dealers in roofing, dampcourse, siding, building, sheathing, insulating and wrapping papers, decorative materials, paints, oils, varnishes, room and picture mouldings, electricians, manufacturers of insulating materials and electrical compounds, &c. The first subscribers (each with one share) are:—R. L. Shainwald, 100, William Street, New York, president of Standard Paint Co.; G. A. Meyer, 93, Dovenhof, Hamburg, managing director of Ruberoid G.m.b.H., Hamburg; E. R. James, 7, Queenswood Road, Forest Hill, S.E., engineer; H. Langdon, 51, Comerford Road, Brockley, S.E., accountant; D. L. Irwin, 54, Adelaide Road, Brockley, S.E., salesman; R. C. Furber, 8, Gray's Inn Square, W.C., solicitor; and H. C. Todd, 78, Headstone Road, Harrow, clerk. No initial public issue. The number of directors is not to be less than three nor more than five; the first are R. L. Shainwald, G. A. Meyer, B. H. Howell and E. R. James. The said R. L. Shainwald, or other the president of the Standard Paint Co., is to be chairman of this company. The said Standard Paint Co. and the Ruberoid Gesellschaft Mit Beschraenkter Haftung may each appoint a director, who shall not require any qualification; remuneration, one guinea each per board meeting attended.

Swan Electric Engraving Co., Ltd. (88,394).—This company was registered on July 5th, with a capital of £10,000 in £1 shares, to acquire the business carried on at 114 and 116, Charing Cross Road, W.C., as the Swan Electrical Engraving Co., to adopt an agreement with D. Cameron-Swan, and to carry on the business of electrotypers, engravers, printers, photographers, &c. The first subscribers (each with one share) are:—J. W. Swan, 58, Holland Park, W., electrical engineer; K. R. Swan, 58, Holland Park, W., barrister; Miss M. E. Swan, 58, Holland Park, W.; Miss D. Swan, 58, Holland Park, W.; D. Cameron-Swan, 114 and 116, Charing Cross Road, W.C., printer and engraver; M. Hicks, Salisbury House, E.C., chartered accountant; and W. Joynson-Hicks, 13, Old Jewry Chambers, E.C., solicitor. No initial public issue. The number of directors is not to be less than two nor more than seven; the subscriptions are to appointment the first; qualification, £100; remuneration as fixed by the company. Registered office, 114 and 116, Charing Cross Road, W.C.

Rhymney Valley and General Electric Supply Co., Ltd. (89,413).—This company was registered on July 6th, with a capital of £5,000 in £1 shares, to carry on the business of suppliers of electric light and power, electrical engineers and contractors, &c. The first subscribers (each with one share) are:—B. Newton, Junction Hotel, Bargoed, licensed victualler; D. Phillips, Hanbury Arms, Bargoed, licensed victualler; D. Protheroe, High Street, Bargoed, ironmonger; J. Powell, Wingfield Cottage, Bargoed, contractor; M. A. Edwards, 61, Hanbury Road, Bargoed, tobacconist and hairdresser; E. L. Watkins, 40, Hanbury Road, Bargoed, butcher; and J. Jenkins, 2, Upper High Street, Bargoed, fruiterer. Minimum cash subscription 25 per cent. of the nominal capital. The number of the directors is not to be less than three or more than nine; the first are B. Newton, D. Phillips, D. Protheroe, J. Powell, M. A. Edwards, E. L. Watkins and J. Jenkins; qualification, 1 share; remuneration as fixed by the company. Registered office, Tenby House, Capel Street, Bargoed.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Peterborough Electric Traction Co., Ltd. (74,562).—This company's annual return was filed on May 7th, when 4,000 ordinary and 4,000 preference shares had been taken up out of a nominal capital of £60,000 in 6,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up, resulting in the receipt of £40,000. Mortgages and charges, £20,000.

Newquay Electric Light and Power Co., Ltd. (85,451).—Issue on July 1st of £2,500 5 per cent. debentures, part of series created June 30th, 1900, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

Empire Electric Light and Power Co., Ltd. (London) (75,545).—A debenture dated June 27th, 1906, to secure £1,100, charged on (1) the Chesham Urban District Council Provisional Electric Lighting Order; (2) the Chesham electric lighting station, machinery therein and site thereof; (3) the company's interest in the Romford Tramways and Electric Lighting Acts, and all land, buildings, plant and machinery of the company in connection therewith; (4) the benefit of two agreements with the Halesowen Rural District Council, respecting the Light Railway Order of the said Council, and the company's interest therein; (5) all moneys payable to the company on the sale or transfer of the said undertaking, whether under Sec. 2 of the Electric Lighting Act, 1888, or otherwise, and the company's undertaking and other assets, including uncalled capital (subject to mortgage for £6,200), has been registered. Holders: Messrs. Le Brasseur and Oakley, 40, Carey Street, W.C.

Julius Sax & Co., Ltd., electricians, London (63,371).—A memorandum of satisfaction in full of debentures dated February 11th, 1904, securing £1,200, has been filed.

Mardy Electric Light Co., Ltd. (52,361).—This company's annual return was filed on May 11th, when the entire capital of £2,000 in £1 shares had been taken up. £2,000 5s. has been received, including 5s. paid on one forfeited share. Mortgages and charges: £600.

Lewes and District Electric Supply Co., Ltd. (64,333).—This company's annual return was filed on May 21st, when 2,507 ordinary shares had been taken up out of a nominal capital of £50,000 in 2,500 ordinary and 2,500 preference shares of £10 each. £20,570 has been received. Mortgages and charges: Nil.

Heswall Electric Light Co., Ltd. (55,482).—This company's annual return was filed on June 13th, when 1,225 shares had been taken up and paid for in full out of a nominal capital of £1,500 in £1 shares. Mortgages and charges: Nil.

Thomson-Davis Telephone System, Ltd. (64,901).—This company's annual return was filed on May 4th, when 5,695 shares had been taken up out of a nominal capital of £6,000 in £1 shares. £1 per share has been called up on 842 and 7s. 6d. per share on 360, resulting in the receipt of £947. £30 remains in arrears. 4,493 shares are considered as fully paid. Mortgages and charges: Nil.

Electric and Ordnance Accessories Co., Ltd. (71,240).—This company's annual return, made up to May 23rd, has been filed. The entire capital of £50,000 in £1 shares has been taken up and paid for in full. Mortgages and charges: £130,000. Since the date of the return, the capital has been increased to £150,000 and the £100,000 new shares have been taken up subject to payment in cash.

Penarth Electric Lighting Co., Ltd. (52,912).—This company's annual return was filed on May 21st, when 2,500 ordinary shares had been taken up out of a nominal capital of £50,000 in 2,500 ordinary and 2,500 preference shares of £10 each. £25,000 has been received. Mortgages and charges: Nil.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—This company's annual return was filed on June 11th, when the entire capital of £750,000 in 75,000 ordinary and 75,000 preference shares of £5 each had been taken up. £750,000 is considered as paid. Mortgages and charges: £425,000.

Market Drayton Electric Light and Power Co., Ltd. (72,677).—This company's annual return was filed on May 28th, when 1,291 shares had been taken up out of a nominal capital of £15,000 in £10 shares. £10 per share has been called up and £12,910 has been received. Mortgages and charges: Nil.

United Electric Tramways of Monte Video, Ltd. (89,456).—A trust deed dated June 19th, 1906, securing £300,000 further debenture stock (supplemental to a trust deed of July 12th, 1905, covering £500,000 debenture stock) has been registered. Property charged: Certain debentures and shares, and a debt due from another company, as set out in original trust deed, and certain additional debentures, &c., specified in supplemental deed. Trustees: Major Sir Wm. E. E. Gordon, M.P., 4, Chelsea Embankment, S.W.; the Hon. Claude G. Hay, M.P., Basildon House, E.C.; and H. A. Trotter, 7, Mincing Lane, E.C.

Metropolitan Electric Tramways, Ltd. (42,526).—A trust deed dated May 28th, 1906 (supplemental to a trust deed of April 28th, 1904), securing £250,000 debenture stock ranking *pari passu* with £350,000 stock already issued, has been registered. Property charged: Various tramways, light railways, buildings, land and shares, and the company's other assets and undertakings, present and future, including uncalled capital (being the same property as charged by original trust deed). Trustees: Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Dixon & Corbett and R. S. Newall & Co., Ltd. (lightning conductor manufacturers, &c., London). (24,228).—Issue on June 19th of £8,200 5 per cent. debentures, part of series created October 25th, 1904, to secure £35,000, charged on the company's undertaking, lands, hereditaments and property, present and future, except uncalled capital. Trustees: F. Kemp, Mosley Street, Manchester, and T. Bowden, Newcaste-on-Tyne. Previously issued of same series: £24,900.

Oriental Telephone and Electric Co., Ltd. (40,691).—This company's annual return was filed on May 15th, when 179,313 ordinary and 50,000 preference shares had been taken up out of a nominal capital of £300,000 in 200,000 ordinary and 100,000 preference shares of £1 each; £1 per share has been called up on 7,816 ordinary and 50,000 preference, and £57,828 10s. has been received, including £12 10s. paid on 50 ordinary shares forfeited; £171,497 ordinary are considered as fully paid. Mortgages and charges: £100,000.

Cork Electric Tramways and Lighting Co., Ltd. (Registered in Dublin).—Issue on June 11th of debentures for £2,000, part of a series created by resolutions of June 9th, 1898, November 22nd, 1899, December 17th, 1900, September 15th, 1902, and March 7th, 1905, securing £115,000. Property charged: Certain freehold and leasehold hereditaments. Trustees under deed of February 8th, 1899: Sir Chas. R. Wilson, R.C.M.G., 21, Pont Street, S.W.; and J. F. Naubaim, New Court, St. Swithin's Lane, E.C. Previously issued of same series: £113,000.

CITY NOTES.

Electric Supply Corporation.

THE report for 1905 states that there is a debit balance of £294 carried to the general balance-sheet. The company has received from the guarantors £3,967, the amount sufficient to extinguish the above debit balance, and to provide for the payment of an interim dividend at the rate of 5 per cent. per annum for the six months ended June 30th last. The dividend received from the Chelmsford Electric Lighting Co., the only undertaking possessed by the Corporation which is fully established, was again at the rate of 6 per cent. per annum. The actual net profits of that company for the year were £3,817, and the dividend declared amounted to £2,123.

The gross revenue from the installations in Dalkeith, Dollar, Jedburgh and Melrose amounted to £1,533, as against £588 in 1904, whilst from the accounts of the Totnes Electricity Supply Co. there appears a loss of £210 on its first completed year's working. The gross revenue of that company, however, showed a steady improvement. During the past year supply of electricity has commenced at St. Andrews, Exmouth and Hitchin, and current to the value of £527 was sold in the two first-named places. The work at Falmouth and Dumbarton is progressing satisfactorily, and applications from consumers are being received. The demand for current in the several towns is steadily increasing. The total number of lamps connected to the company's systems on December 31st, 1905, was equivalent to 38,115 lamps of 8-C.P. each, and 4,195 were awaiting connection; since that date the number of lamps connected and applied for has considerably increased. The company has applied for a provisional order for an electric tramway from Clydebank to Dumbartion, and from Dumbarton to Ballock, on the shore of Loch Lomond. This tramway may by agreement be connected up at Clydebank with the Glasgow system of tramways. Additional capital will be required for the purpose of completing the full amount of work secured for this company, and this matter is receiving the careful consideration of the directors.

National Telephone Co., Ltd.

At one of the recent half-yearly meetings of the company, Sir HENRY FOWLER stated that the opinion of eminent counsel would be taken as to the legal rights of the various classes of debenture stockholders and shareholders upon the winding up of the company on the transfer of its plant and property to the Postmaster-General after December 31st, 1911. Mr. Ralph Nevill, K.C. (now Mr. Justice Nevill), and Mr. Francis B. Palmer have given their opinions, which have been communicated to the shareholders. Counsel consider that the debenture holders will be entitled to receive par value plus accrued interest, but no premium; the first and second preference shareholders will be entitled to be repaid the capital paid up on their shares, but will not be entitled-to participate in "the excess"; the third preference shareholders will be entitled to the repayment of their holdings, and also to participate in "the excess"; the preferred stockholders will be entitled to a return of their capital, in addition to a premium of 5 per cent., before the deferred stockholders receive anything, but as between the holders of the third preference shares and of the preferred and deferred stock, the 5 per cent. premium on the deferred stock must be treated as payable exclusively out of the assets which would otherwise have been available for distribution amongst the holders of the deferred stock, and not so as to diminish what the holders of the third preference shares will receive. Answering the final question as to whether the deferred stockholders will be entitled to the whole of the surplus assets counsel say: "It appears to us that the ultimate surplus must be divided into two parts bearing the same ratio to one another as the third preference shares bear to the aggregate amount of the preferred ordinary stock, and that the one part should be divided amongst the holders of the third preference shares in proportion to the third preference shares held by them respectively, and that the other part should be divided amongst the holders of the deferred stock in proportion to the deferred stock held by them respectively, less the 5 per cent. premium paid on the preferred stock as above indicated." Mr. J. M. Astbury, K.C., M.P., and Mr. A. R. Kirby concur in effect with the opinions of Messrs. Nevill and Palmer.

The French Thomson-Houston Co.

The report of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, which was adopted at the recent general meeting held in Paris, shows that the securities in portfolio at the end of 1905 were valued at £2,480,000 as compared with £2,540,000 on December 31st, 1904. The difference between these two totals is represented by the changes made in the composition of the share holdings and other securities, and by the new valuation undertaken at the close of the year. In the first place, the securities to the extent of 75 per cent. are composed of French Rentes and various obligations, and shares in industrial companies in which the company is interested, and the equipment of which is now considered complete. The remaining 25 per cent. of the portfolio values relates to undertakings initiated by the company, the natural development of which has to be waited for until the normal working period arrives. After referring in detail to a number of electric tramway and lighting companies comprised among these investments, the report states that the Société des Ateliers Thomson-Houston has developed well during the year. The plant required to meet the orders for the Curtis turbine, of which the company acquired the patents, has been installed and put in operation. The first installation of Curtis turbines, which was made for the Nice Gas and Electricity Co., has yielded entirely satisfactory results, and the orders for the engines are becoming more numerous. A year ago the orders for turbines represented 9,750 KW., and from that time they have risen to 32,100 KW. As the Société des Ateliers Thomson-Houston has been unable to devote the desired amount of attention to the business on the site in the Rue de Vaugirard, the company proposes to establish auxiliary works specially for the construction of the turbines. The report of the Compagnie Française proceeds to remark that the company has just received from the Nice Gas and Electricity Co. a repeat order for turbines, and orders from the Marseilles Gas Co. for the equipment of the works being established at that port, and for electrical and mechanical plant for certain tramways, hydro-electric works and lighting stations. The Paris Metropolitan Railway Co., which is satisfied with the train control equipment supplied by the company two years ago, has ordered similar equipment for 36 new coaches. In general, the orders received down to the present time have been more considerable than at the same period a year ago, and the improvement in business recorded in the last report has been maintained, although the prices of manufactures have not yet sufficiently advanced. The accounts show net profits of £84,430 for 1905, as compared with £85,000 in the previous year, and a dividend of £1 per share has been declared on the ordinary capital of £1,600,000, being the same rate as was paid in 1904. The value of the 4 and 5 per cent. obligations in circulation is £1,100,000.

General Electric Co., Ltd.

THE report of the directors which is to be presented at the meeting to be held to-day, gives the following results for the year ended March 31st, 1906:—

The net trading profits and income from investments, &c., amount to	£70,149	
After deducting depreciation and debenture interest amounting to	25,554	
There remains a balance of		£44,595
Out of which the dividend on the preference shares at the rate of 5 per cent. for the year has been paid, absorbing		£12,500
Leaving an available balance of		£32,095
Which the directors recommend should be appropriated as follows:—		
To payment of managing directors' and employés' bonus	£3,210	
To payment of dividend on ordinary shares at the rate of 5 per cent. for the year ended March 31st, 1906	16,561	
To reserve account	12,324	
		£32,095
THE RESERVE ACCOUNT—		
The reserve account stands in the accounts at being the amount of undivided profits as at March 31st, 1905	£96,253	
The proposed appropriation of the undivided profit of the year amounts to	12,325	
Giving a total reserve account of		£108,578

The sales of all departments have shown an increase during the year, yet the trading profits have not benefited therefrom proportionately owing to the continued rise in price of raw materials without a corresponding increase of selling prices. The slight improvement in the general trading noticeable during the last few months has not affected the balance-sheet under review, but has materially helped to fill the order books for the current year.

The Witton Engineering and Carbon Works have been increased during the year owing to progressive results, and are at present in a very good condition. The machinery turned out from Witton Works has gained steadily in popularity, many large contracts have been carried out, and are leading to repeat orders.

Further ordinary shares to the number of 1,372 were allotted during the period covered by the balance-sheet to the directors at par.

During the year Mr. A. Eckstein tendered his resignation as a managing director, which was accepted by the board.

Mr. Railing retires by rotation from the position of director, and offers himself for re-election.

[For the previous year the dividends were at the same rate, but £15,987 was carried to reserve.]

Electrical Power Storage Co., Ltd.

THE meeting of this company was held on Thursday last week at Winchester House, E.C., Mr. J. Irving Courtenay presiding.

In moving the adoption of the report, the CHAIRMAN said that the balance-sheet showed, after payment of debenture interest, a profit for the year of £8,604, which, together with £711 carried forward from last year, made a total of £9,315. They recommended a similar dividend to that of the last three years, viz., 6 per cent., which would absorb the sum of £5,390, leaving the sum of £425 to be carried forward. There had been spent on maintenance, renewal and repair of buildings, plant and tools, the sum of £3,663, and £1,824 had been spent on account of new plant. This year they had expended a somewhat heavy sum on account of exhibitions. In addition to the Electrical Trade Exhibition at Olympia in the autumn of last year, they had exhibited at two smaller exhibitions, one in connection with tramways and the other with collieries. The result of these exhibitions was not confined to the financial year just completed, for they would doubtless derive benefit from them in the present and succeeding years. The directors, had, however, written off the whole of the expenditure so incurred out of the revenue of the year. Had it not been for this special expenditure the profit would have been even larger than last year. Considering the prevailing depression in their particular branch of the electrical trade and the keenness of competition, which rendered prices very low, together with the fact that they had had to face an abnormal rise in the cost of raw materials, especially their staple commodity, viz., lead, the result was eminently satisfactory. The year which had just closed was specially noticeable for the diminution in the amount of orders placed for large or central station batteries, and no doubt the difficulty which many corporations were finding in obtaining money for such enterprises and extensions was the chief cause of this diminution. Of such business, however, as there had been, the company had certainly had their full share, and during the year they had completed batteries for the following:—Preston, Bury St. Edmunds, Dartford,

Stoke Newington, Oxford, Chelsea Electricity Supply Co., Ltd., and they had at present on their books, amongst others, batteries for Marylebone, Chelsea Electricity Supply Co., Ltd., Sheerness Dockyard (Admiralty), Ilford, and Birmingham. With reference to the Birmingham contract, it might be interesting to mention that their first battery was supplied to the old company, which had since been absorbed by the Corporation, in 1891, and they had had repeat orders from them on no fewer than six occasions. With regard to batteries for the propulsion of automobiles their business was still increasing, although not as rapidly as they would like. They were continually making improvements in that class of battery, and at the present time there was no carriage which could compare with the electric carriage for town use, although for touring purposes the electric car was not so well adapted. In connection with electrically-propelled vehicles the company was giving special attention to the question of electrically-driven omnibuses. At the present time, in conjunction with other engineers, they were considering the matter, and hoped before very long to have a specimen 'bus running in London. In the meantime, not having had sufficient experience in this class of vehicle, they preferred not to make any definite statement concerning them. The success of the vehicle did not depend on the cost of upkeep of the accumulator alone; if it did, from their experience with other vehicles, they could safely say that there was no reason why electrically-propelled omnibuses should not be the solution of the much-discussed question of motor vehicles for such purposes in crowded traffic. During the past few months many of the shareholders might have noticed extravagant statements appearing in the daily Press with reference to new methods of manufacture and discoveries in regard to storage batteries, mainly originating from the other side of the Atlantic. These had generally been connected in some way with more or less rare metals, and had been accompanied by the information that those owning or interested in the discoveries were making arrangements to purchase the whole, or the greater bulk, of the world's supply of the particular metal required. It was difficult to understand why such precautions should have been taken unless it was that those people, being convinced that they were unable to obtain a monopoly by patent rights, had endeavoured to ensure it by that means; but he thought the general public must be getting somewhat tired of hearing year after year similar statements without any of the promised results being forthcoming. From their own experience, they considered that there was no more probability of those new batteries developing into successful commercial articles than there had been in those which had been previously put forward. In fact, he was advised by their technical staff that nothing short of a discovery which would revolutionise the accepted theories of the chemistry of metals would be able to oust lead from the position that it occupied to-day as being the only metal from which a satisfactory commercial storage battery could be manufactured. He thought the outlook was distinctly encouraging, and he hoped that they had seen the worst of the depression in their branch of the electrical industry.

The report was adopted.

Chili Telephone Co. Ltd.

THE meeting was held on Thursday last week at the offices, 42, Old Broad Street, E.C., Mr. Geo. Keith presiding. In moving the adoption of the report, the CHAIRMAN said that the gross revenue in Chili from all sources was $1,090,569, which was an increase of $111,823 over the previous year, a very favourable comparison. Expenditure had increased in the same proportion, the figures being $501,032 for 1905-6, and $445,140 for 1904-5. The winter in Chili had been very severe, and the plant in some districts had suffered much from storms, which had made the work of maintenance difficult and expensive. The item of labour had also been rather heavy. The number of subscribers at all centres at the end of the year was 7,270, compared with 6,274 at the beginning, showing 996 additional subscribers during the 12 months. The net income in Chili from all sources was $589,536, showing an increase of $55,930. The average rate of exchange being 15·24d., compared with 16·30d. in the previous year, the figures converted into sterling were £37,435 for 1905-6, and £36,227 for 1904-5. £7,010 had been expended during the year on new construction. The balance to the credit of the revenue account was £36,372, of which the sum of £16,119 had been placed to reserve. They now proposed to pay a dividend of 5s. per share, which with the interim dividend of 3s. would make 8s. per share for the year. In conclusion, he remarked that business in Chili was, generally speaking, in an active and prosperous condition, and he thought they might look forward to increased prosperity.

Mr. F. W. JONES seconded the motion, and the report was adopted.

Edmundsons' Electricity Corporation. Ltd.

THE directors' report for the year ended March, 1906, says that, including the sum of £15,007 brought forward from last year, the net profit, after payment of debenture interest, amounts to £59,174. After deducting dividends on preference shares paid and accrued, amounting to £24,000, and an interim dividend of 2½ per cent. on the ordinary shares, amounting to £10,000, there remains a balance of £25,174, out of which the directors recommend a final dividend on the ordinary shares at the rate of 3 per cent. per annum (making 4 per cent. for the year), £6,000, adding to reserve fund £3,962, and carrying forward £15,212. During the year £105,000 debenture stock has been issued. The premiums received in respect of this issue, less expenses, amount to £1,038, and have been added to the reserve fund, which, with the contribution proposed to be made from revenue account, will be thereby increased to £95,000. In consequence of the smaller amount of installation work done during the year under review compared with the previous year, the trading profit shows a considerable diminution. The directors regret that, on the other hand, the increase of income from investments has not compensated for this deficiency. They believe, however, that an improvement in this direction is now being experienced. A list of the shares and debentures held by this corporation and of advances made to affiliated companies appears below. All the stations in which the corporation is interested are now opened and at work. The total number of equivalent 8-C.P. lamps connected at end of March, 1906 (exclusive of the Lancashire Power Co.). is 934,119, showing an increase on the year of 172,666. Mr. F. E. Gripper has resigned his position as chairman of the corporation, but retains office as joint managing director. Mr. H. Wolfenden has been elected chairman and joint managing director.

INVESTMENTS IN AND ADVANCES TO SUBSIDIARY COMPANIES.

Company.	Areas of supply.	Shares.	Debentures.	Advances.
Alderley & Wilmslow E.S. Co.	Alderley Edge and Wilmslow.	£3,856	£5,000	£36,762
Bromley (Kent) E.L. and P. Co.	Bromley and Chislehurst	23,100	—	—
Folkestone Elec. Supply Co.	Folkestone, Sandgate and Hythe.	13,475	—	—
Isle of Wight E.L. and P. Co.	Ryde, Newport, Ventnor, Sandown, Shanklin and Cowes.	118,915	5,800	44,459
Ilfracombe E.L. and P. Co.	Ilfracombe	335	—	35,010
Lancashire Power Construction Co.	——	79,010	—	—
Lymington E.L. and P. Co.	Lymington	8,770	9,600	12,469
Melton Mowbray E.L. Co.	Melton Mowbray	11,960	14,900	10,050
Newmarket E.L. Co.	Newmarket	5,650	8,000	—
North of Scotland E.L. and P. Co.	Montrose, Brechin and Inverness.	49,470	—	47,436
Ramsgate and District El. Sup. Co.	Ramsgate	—	—	34,103
Scarborough Tramways Co.	——	—	—	97,931
Salisbury E.L. and Supply Co.	Salisbury	25,119	20,000	4,721
Urban Elec. Supply Co.	Camborne, Redruth, Glossop, Twickenham, Hawick, Grantham, Berwick-on-Tweed, Godalming, Newton Abbot, Stamford, Dartmouth, Weybridge, Newbury and Caterham.	236,820	—	172,961
Winchester E.L. and P. Co.	Winchester	16,815	9,000	—
Wycombe (Boro') E.L. and P. Co.	High Wycombe	31,160	26,000	30,385
		£624,455	£98,300	£526,277

SUMMARY.

Shares	£624,455
Debentures	98,303
Advances	526,276
Investment in Guernsey undertaking	131,796
Investment in Cromer, Dorking, Frome, Hamilton and Surbiton (local authorities) undertakings ..	32,274
	£1,413,101

Of the above investments £398,474 has not yet reached a dividend-earning stage.

[The dividend on the ordinary shares for the previous year was 7 per cent.]

Diesel Engine Co., Ltd.

THE report for the year ended March 31st last states that the operations of the company during the period covered by the accounts have largely increased, and the prospects have much improved. The credit balance of trading account shows £11,162, plus £1,485 royalties, or a total of £12,647 as the gross profits made, against £7,404 last year. This shows an increase of about £5,000, and the directors are glad to report that since March 31st the rate of progress has considerably increased. The directors point out that out of the £4,471 at the credit of profit and loss account for the current year, £1,499 had to be paid away in respect of contracts entered into in the year 1903-1904, and also £212 on account of income-tax for which the company was liable owing to the accounts of that year having shown a profit. The best indication of the continued expansion of the business is supplied by the following facts:—The value of orders booked in the financial year to which the accounts refer, exceeded by about 50 per cent. those booked during the previous year. The turnover during the same period exceeded that of the previous year by over 50 per cent., and at the end of the first three months of the current financial year the orders in hand exceeded by over 20 per cent. the total turnover of the previous year. The estimated profit on these orders alone is considerably more than sufficient to cover the entire working expenses of the year. At the present time the turnover is limited by the speed at which it is possible to obtain delivery of engines on order. This matter has received the careful attention of the Board, and steps have been taken in order to secure earlier delivery to meet requirements. The directors have not as yet been able to effect the reduction of capital passed at the meeting on May 30th, 1905. Meetings to carry out this scheme are, however, to be called immediately, as until this has been effected, it will not be advisable to declare a dividend even when the anticipated considerable profits have been earned.

Direct United States Cable Co., Ltd.

THE directors' report for the half-year ended June 30th, 1906, shows a revenue, after deducting outpayments, amounting to £56,265, as compared with £49,470 for the corresponding period of 1905, showing a difference of £6,795 in favour of the half-year under review. The working and other expenses for the same period, including income-tax, but exclusive of cost of cable maintenance, amounted to £23,924, leaving a balance of £32,341 as the net profit, making, with £5,849 brought forward from the previous half-year, a total of £38,189. For the corresponding period of 1905, the working expenses and other payments amounted to £22,572. Interim dividends of 3s. per share for the quarter ended September 30th, 1905, 3s. 6d. per share for the quarter ended December 31st, 1905, and 4s. per share for the quarter ended March 31st, 1906, amounting to £31,873, have been declared and paid during the financial year, and a final dividend of 4s. per share is now proposed, together with a bonus of 2s. 6d. per share, making, with the three interim dividends, 4¼ per cent. for the year, being a total distribution of £51,603. The balance of £6,317 on the revenue account is proposed to be carried forward. The reserve fund account has been debited with £7,144 for the cost of cable maintenance, and after being credited with interest on the investments and profit on sale of securities, the balance now amounts to £504,184, taking the investments at cost price.

Official Announcements re Companies.

THE following companies have been struck off the register:—

Blakey, Emmott & Co.
Electric Locomotive and Power Co.
Electrified Rooms Co.
Electro-Metal Extracting, Refining and Plating Co.
Patent Electric Fire Lighter Co.
Telephone Association.

The following will be struck off in three months unless cause is shown to the contrary:—

Corinthian Electro-Medical Battery Co.
Dessole Electro-Plating Co.
Domestic Battery Syndicate.
"Eclipse" Electric Lighting Syndicate.
Geo. F. Milnes & Co. (registered 1898).
Humboldt Electric Power and Mining Co.
Marylebone Electric Supply Co.
Mazarron Electric Light Co.
Mining and General Electric Lamp Co.
Mudge Marchant Engine Co.
Norwich Mutual Telephone Co.
Petersen's Water-Tube Boiler Co.
Redditch District Electric Traction Co.
Rhea Insulite Syndicate.
Ward Electrical Car Co.
Windsor and Eton Electric Light Co.

Montreal Light, Heat and Power Co.—A dividend has been declared for the past three months at the rate of 5 per cent. per annum.

Prospectuses.—*Cleveland and Durham Electric Power Co., Limited.*—A new company has been formed to take over the Cleveland and Durham Electric Power Co. (which has Parliamentary powers for the supply of an area of 820 square miles in the Tees district and the South and West Durham coalfields), and to secure a controlling share in the Northern Counties Electricity Supply Co., which is supplying energy for power and lighting in many parts of Northumberland, Durham, and North Yorkshire. In order to do this it is proposed that shares in the latter company should be purchased at 25s each, the shareholders being given the option of selling or of taking shares, to the value of the purchase price in the new company. As will be seen from our advertisement columns, the capital of the new company, the Cleveland and Durham Electric Power, Ltd., is £1,000,000, and the board of directors, an influential one, including Sir John D. Milburn (chairman of the Newcastle and District and Northern Counties' Supply Cos.), and others who are closely identified with electric or other industrial undertakings in the district. The directors have secured the services of Messrs. C. H. Merz and W. McLellan, who have been so prominently connected with the development of the Newcastle-on-Tyne and County of Durham Supply Companies. These gentlemen estimate that the possible demand upon the company's supply amounts to upwards of 150,000,000 units per annum. The Newcastle-on-Tyne Electric Supply Co. is stated to have made an offer by which it will work certain operating stations upon very favourable terms to the new company. It is expected that considerable economies can be effected by this fusion of interests and centralisation of control. The subscription lists in the new company will open to-day (Friday). The share capital is divided into 70,000 5 per cent. preference, 70,000 6 per cent. ordinary (being entitled to a possible further participation in profits), and 60,000 deferred shares, all of the value of £5 each.

Rosario Electric Co., Ltd.—This company is offering an issue of 15,000 6 per cent. cumulative second preference shares of £5 each, convertible up till 1917 into ordinary shares.

Havana Telephone Co.—Messrs. Frederick J. Benson & Co. have been inviting subscriptions for £246,250 five per cent. 1st mortgage debentures in this company at 97 per cent.

Victoria Falls Power Scheme.—The *Financier* says:—"It is pretty generally known that the Chartered Co. has succeeded in financing the first stage of the huge electrical scheme to bring power to the Rand goldfields from the Victoria Falls, on the Zambesi. We are in a position to state that the capital is fixed on the basis of six millions sterling, divided as follows:—£1,000,000 deferred vendor shares; £2,000,000 preference shares; £3,000,000 debentures. This capital is to be issued in sections as the work progresses. The first section has been taken as to one-half by the Allgemeine Elektricitäts Gesellschaft, of Berlin, and a syndicate of banks with which this great financial corporation usually co-operates in its important undertakings, and the other half by the Chartered Co. and its allies. An early public issue of the undertaking in some form may be confidently anticipated."

Cicely Rubber Estates Co., Ltd.—In the report for the 15 months ended March 31st, 1906, it is stated that in addition to 6,919 rubber trees now being tapped, there are about 2,000 trees fit for tapping. In June, 1906, another small piece of land was purchased, containing 268 rubber trees, of which 176 are ready for tapping. 9,184 lb. of rubber were harvested during the period under review, and sold for a net average of 5s. 6d. per lb. The estimate for the year ending March 31st, 1907, is 15,000 lb.

Vallambrosa Rubber Co., Ltd.—The report for the year ended March 31st, states that the amount of rubber harvested during the year was 39,113 lb., producing £10,745, or about 5s. 6½d. per lb. The cost of tapping, packing and transport was 1s. 1½d. per lb. The directors consider that it is in the best interests of the shareholders not to recommend payment of any dividend at present. They hope, however, out of the proceeds of the crop of the current year to pay an interim dividend within the next few months. They point out that the cost of increased acreage and of development has largely exceeded the amount of working capital provided on the formation of the company.

City and South London Railway Co.—The accounts for the half-year ended June 30th last show after providing for the debenture stock interest, payment of dividend on the preference stocks and the transfer to the renewal fund of £1,500, a balance sufficient to allow of a dividend on the consolidated ordinary stock at the rate of 2¼ per cent. per annum, carrying forward £1,870. For the corresponding period last year the dividend was at the rate of 2 per cent. per annum, carrying forward £1,041.

Parsons' Foreign Patents Co., Ltd.—The *Times* says that dividends have been declared of 6s. per share on the ordinary shares, and of 15s. per share on the deferred shares, for the year ended June 30th last.

Metropolitan Railway Co.—The directors recommend a dividend on the ordinary stock for the past half-year at the rate of 1½ per cent. per annum, carrying forward about £4,000. The dividend on the Surplus Lands stock will be at the rate of 2¾ per cent. per annum, carrying forward about £200. Last year the dividend on the ordinary stock was 2½ per cent., and the Surplus Lands stock 2⅝ per cent.

South Wales Electric Power Distribution Co., Ltd.—The meeting of the debenture-holders of this company on 12th, inst., was private, and the Press were not admitted. A representative of the *Financial News* was informed that Sir W. T. Lewis, Bart., presided, and that, after considerable discussion, the following resolution was unanimously adopted:—"That the following gentlemen be appointed a committee on behalf of the debenture stock holders, to confer with the board in regard to the future management of the company and the satisfaction of its creditors, and also in regard to the terms and conditions of issue of any prior lien stock or preference shares, the issue of which may be authorised by the Bill now pending in Parliament: Messrs. Stanley Boulter, William Fleming, Grenfell, Ling, and Collis."

Vickers, Sons & Maxim., Ltd.—An interim dividend for the half-year ended June 30th last of 1s. each on the ordinary shares is recommended.

City of London Electric Lighting Co., Ltd.—Warrants in payment of the dividends "on account" of the year ending December 31st, 1906, on the preference and ordinary shares were duly posted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British Aluminium Co.—20,000 conversion shares of £10 each £1 paid.

And to allow the following securities to be quoted in the Official List:—

Western Telegraph Co.—Further issue of £235,620 four per cent. debenture stock.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Canadian General Electric Co.—London certificates for 11,000 shares of $100 each, fully paid, together with 36,000 additional shares.

Newcastle-on-Tyne Electric Supply Co., Ltd.—A financial contemporary says that the directors have decided to pay an interim dividend at the rate of 5 per cent. per annum on the ordinary shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open. *
Aberdeen	July 11	3,090	+ 31	6	8,705	— 212	14·4 ..
Ayr	,, 7	740	— 11	8	2,494	— 187	8 ..
Bath	,, 14	1,930	+ 402	28	21,189	+ 3,785	13 ..
Belfast	,, 13	7,583	+2,203	28	89,329	+24,296	40 + 6½
Birkenhead	,, 15	2,161	— 52	15	16,160	+ 124	13·5 ..
Blackburn	,, 11	2,247	+ 219	15½	16,563	+ 1,038	13·5 ..
Blackpool Corp.	,, 12	2,841	— 77	15	15,801	+ 549	11·87 ..
,, —Fleetw'd	,, 14	1,888	+ 127	2	1,888	— 20	8·25 ..
,, —Lytham	,, 12	1,198	+ 85	36	10,487	+ 1,296	7½ ..
Bolton	,, 15	4,508	+ 270	15	32,921	+ 2,030	26 + 1
Bournemouth	,, 11	3,394	+ 350	14½	24,103	+ 5,839	18·75 + 6⅔
Bradford	,, 14	9,487	— 114	15	70,327	+ 2,885	53 ..
Brighton	,, 15	2,137	— 219	15	14,849	..	9·5 ..
Bristol	,, 13	11,413	+ 496	..	..	..	28·5 ..
Brit. Elec. Trac. Co							
Airdrie	July 6	462	+ 34	27	5,921	+ 597	3·65 ..
Barnsley	,, 6	815	— 14	,,	4,319	+ 25	.. ..
Barrow	,, 6	596	— 80	,,	6,359	+ 288	5·37 ..
Cavehill	,, 6	206	+ 80	,,	2,049	+ 611	.. ..
Devonport	,, 6	975	— 5	,,	11,734	— 447	8·85 ..
Gateshead	,, 6	2,153	+ 123	,,	25,379	+ 1,219	11·25 ..
Gravesend, N'fleet	,, 6	582	+ 28	,,	6,131	+ 281	6·5 ..
Greenock	,, 6	1,638	+ 21	,,	17,433	+ 911	7·25 ..
Hartlepool	,, 6	727	+ 200	,,	7,541	+ 762	6·72 ..
Kidderminster	,, 6	289	— 3	,,	2,943	— 50	.. ..
Leamington	,, 6	639	+ 531	,,	4,532	+ 2,708	8 ..
Merthyr	,, 6	403	+ 30	,,	5,156	+ 53	2·9 ..
‡Metropolitan	,, 6	7,557	+ 626	,,	88,014	+25,037	22 ..
Middleton	,, 6	809	— 32	,,	9,156	+ 399	8·5 ..
Mid. Joint Com'tee	,, 6	20,759	—1,040	,,	273,583	+19,617	.. ..
Oldham — Ashton	,, 6	1,184	— 25	,,	14,893	+ 507	9·13 ..
Peterborough	,, 6	390	— 140	,,	3,129	— 400	5·31 ..
Potteries	,, 6	8,784	+ 169	,,	47,515	+ 2,511	29 ..
Rothesay	,, 6	795	+ 262	,,	3,885	+ 1,101	2·75 ..
Southport	,, 6	766	+ 18	,,	7,933	+ 121	8·17 ..
Swansea	,, 6	1,649	— 70	,,	21,121	+ 4,342	5·5 ..
Tynemouth	,, 6	838	— 16	,,	6,067	— 141	3·75 ..
Weston-s-Mare	,, 4	490	+ 53	,,	2,394	+ 121	3 ..
‡Worcester	,, 6	658	— 41	,,	7,146	— 644	5·75 ..
Wrexham	,, 6	221	+ 23	,,	2,647	— 4	.. ..
Yorks. Wool. Dist.	,, 6	1,853	+ 479	,,	23,673	+ 7,093	17 ..
Miscellaneous	,, 6	221	— 60	,,	2,613	— 382	.. ..
Burnley	,, 14	2,718	+ 278	27	..	..	7·5 ..
Burton-on-Trent	,, 15	639	— 48	15	4,605	— 335	9·5 + 1
Bury	,, 8	2,034	..	14	14,230	..	10·5 ..
Cardiff	,, 7	4,360	— 771	14	29,188	— 1,115	15·87 ..
†Carlisle	June 23	197	— 21	25	4,313	+ 45	.. ..
Chatham and Dist.	July 12	1,487	— 146	28	17,517	— 173	10·29 + ·96
Colchester	Mar. 7	327	— 5	31	5,660	..	7½ + ½
Cork	July 12	1,195	— 46	28	12,892	— 349	9·89 ..
Croydon	,, 13	3,227	+ 95	6	10,188	+ 841	11·25 + ·2
Darlington	,, 14	442	+ 2	15	3,191	+ 120	4·57 ..
†Darwen	,, 6	268	+ 17	14	3,593	+ 112	4·36 ..
Dover	,, 14	631	+ 106	15	3,858	+ 514	4·75 + 1½
Dublin	,, 13	9,931	— 509	2	9,931	— 649	18·75 + ·25
Dundee	,, 11	2,223	+ 479	28	8,877	+ 1,797	12·5 ..
East Ham	,, 14	1,950	+ 121	15	14,321	+ 1,426	8 + ½
Exeter	,, 12	612	— 34	15	4,340	— 425	4·25 ..
Glasgow	,, 14	33,984	+1,782	7	111,811	+ 7,064	80·25 + 4½
†Gloucester	Feb. 21	221	+ 12	..	..	..	15 ..
Halifax	July 11	3,500	+ 59	15	25,491	+ 1,277	37 + 1·5
Hastings	,, 13	1,650	..	..	..	..	.. ..
Huddersfield	,, 14	3,065	+ 163	15	23,215	+ 2,372	28 ..
Hull	,, 14	4,705	+ 189	15	33,830	+ 885	13 ..
†Ilford	,, 7	551	— 12	14	7,235	+ 196	6·37 ..
Ilkeston	,, 11	285	+ 38	15	1,974	+ 78	3·5 ..
Ipswich	,, 14	957	— 128	15	6,582	— 203	10·5 ..
Isle of Thanet	,, 14	2,224	— 224	28	12,398	— 623	11 ..
Kilmarnock	,, 14	334	— 13	9	1,368	— 69	4·12 ..
Kirkcaldy	,, 11	461	+ 29	..	..	..	7·5 ..
†Lan'kshire Trm Co.	,, 5	982	+ 313	27	23,922	+ 5,393	12·56 + 3·9
Leeds	,, 7	13,181	— 315	14	89,183	+ 4,266	96 + 6½
Leicester	,, 14	4,657	— 69	28	..	..	.. ..
Leith	,, 7	1,132	+ 617	7½	4,104	+ 2,224	6 + 1
Liverpool	,, 7	22,628	— 57	27	285,661	— 5,790	104 + 1
‡L.C.C.	June 30	53,628	..	13	345,839	..	96½ +44¾
London United	July 13	15,004	+ 710	28	166,521	+ 9,631	.. ..
Lowestoft	,, 7	385	— 71	41	5,569	— 404	3·5 ..
Manchester	,, 14	28,945	—1,853	15	205,841	+ 8,090	84 ..
Newcastle	,, 14	9,024	+1,739	15	62,736	+ 4,380	25·5 ..
Newport	,, 14	1,304	+ 21	15	9,524	+ 378	14·5 + 1·5
Northampton	,, 13	1,009	+ 11	15	6,752	+ 35	5·5 ..
Oldham	,, 15	3 695	+ 195	16	28,729	+ 2,275	23·75 ..
Pontypridd	,, 14	329	+ 8	15	2,598	— 12	3·5 ..
Portsmouth	,, 14	4,916	— 1	15	30,649	— 180	14·5 ..
Preston	,, 11	1,612	+ 279	..	..	..	10 ..
Reading	,, 12	1,369	— 93	15	9,443	— 63	7·5 ..
Rochdale	,, 14	2,218	+ 449	15	16,100	+ 5,339	20·6 + 1½
Rotherham	,, 12	1,013	— 2	15	7,371	+ 618	9·33 ..
Salford	,, 9	9,497	+ 464	14	65,210	+ 1,496	38·9 ..
Sheffield	,, 15	10,711	—1,141	16	84,463	+ 4,096	35·75 + 1½
†Southampton	,, 4	1,067	+ 4	13½	13,159	+ 56	.. ..
†Southend-on-Sea	,, 4	458	— 14	14	5,330	+ 341	6 ..
†Stalyb'dge, Hyde, &c	Apr. 21	807	+ 100	3	2,456	..	21 ..
Stockport	July 6	2,116	+ 631	14	13,974	+ 5,168	15·5 + 4
Sunderland	,, 15	3,154	+ 59	15	21,471	+ 1,109	10·87 ..
Swindon	,, 3	331	— 83	13½	2,642	— 49	4·4 ..
†Tyneside	June 20	394	+ 17	25	9,924	+ 517	8·87 ..
†Walthamstow	July 14	687	..	15	10,054	..	10 ..
Warrington	Mar. 29	677	+ 43	52	17,804	+ 1,247	6·37 + ·25
West Ham	June 28	4,728	+1,348	13	29,818	+ 9,687	14·7 + 3½
Wolverhampton	July 11	1,781	..	..	..	..	10 ..
Yorks. W. Riding	,, 15	1,677	+ 74	28	22,639	..	.. ..
Baker St.-Waterloo	,, 14	2,886	..	18	..	..	3·25 ..
Cen. London Rly.	,, 14	12,027	— 397	2	12,027	— 397	6 ..
City & S. Lon. Rly.	,, 15	4,919	+ 361	2	4,919	+ 361	6·25 ..
Dublin-Lucan Rly.	,, 13	231	— 43	2	231	— 43	7 ..
G. N. and City Rly.	,, 14	3,324	+ 358	2	3,324	+ 358	3·5 ..
L'pool Overh'd Rly.	,, 15	3,118	— 134	2	3,118	— 134	6·65 ..
Mersey Railway	,, 14	3,192	+ 220	2	3,192	+ 220	4·5 ..
Metropolitan Rly.	,, 15	30,726	—4,712	2	30,726	— 4,712	70·5 ..
Met. District Rly.	,, 15	16,167	+2,607	2	16,167	+ 2,067	24 ..
Anglo-Argentine	,, 15	29,245	+3,862	28	414,851	+43,766	43 ..
§Auckland	June 22	10,225	+1,319	25	61,419	+ 4,193	18·64 ..
§Brisbane	,,	11,595	+1,506	..	..	..	.. ..
§Brit. Columbia Rly.	May	18,545	+3,681	48	215,505	+44,078	.. ..
†Bu'n's A'r's E.T.Co.	June 9	1,247	+ 134	22	32,082	+ 6,316	24 ..
Bu'n's A'r's-Blgr'no	July 8	6,636	— 464	27	95,908	+ 5,515	.. ..
Calcutta	,, 16	5,952	+ 192	..	..	..	.. ..
§Cape Electric T. Ld.	May	14,806	..	..	..	..	.. ..
§Geneva	June	7,905	..	..	..	..	.. ..
Perth (W.A.)	July 13	2,790	+ 125	28	41,727	+ 2,434	24·25 + 5

* Compared with the corresponding period of 1905. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Summer somnolence provides the usual opportunity for presenting the comparisons of prices given here at this time of year. The quotations in the first column are those of the last business day in 1905. Two final columns are added, containing the highest and lowest prices reached this year. The figures as a whole require little introduction. They reflect the depression prevalent round most of the Stock Exchange markets, and the railway department is one of the dullest. Here are the quotations:—

Stock.	Dec. 30, 1905.	Now.	Fall.	1906. Highest.	1906. Lowest.
Central London Ordinary	94½	87	7½	96½	84¾
,, ,, Deferred	86½	75½	11	89	75
City and South London	45	43	2	44¾	39
Great Northern and City Pref.	5¼	3⅝	1⅝	5⅝	3⅜
Metropolitan	87	64	23	89½	65⅜
Metropolitan District	35⅝	24	11⅛	37½	22
Waterloo and City	95⅝	101½	+6	102½	94

Following this, the Electricity Supply section adds another damper to the weak prices given above. The causes are too topical to need reiteration, and the figures, like the ladies, speak for themselves:—

Shares.	Dec. 30, 1905.	Now.	Fall.	1906. Highest.	1906. Lowest.
Brompton and Kensington	9	8¼	¾	9¼	8¼
Charing Cross	6¼	4½	1¾	6¼	4¼
City of London	11⅛	*10½	1⅛	11⅛	10½
County of London	9	8⅜	⅝	9⅛	8⅛
Edmundson's	5⅛	3⅝	1½	5⅝	3½
Kensington and Knightsbridge	11⅛	10¼	⅞	11⅜	10
Metropolitan	10	8⅞	1⅛	10¼	8
Notting Hill	14¼	14	¼	14¼	13⅜
St. James's	13½	11	2½	13½	9½
Urban	4⅜	3⅜	1	4⅛	4⅛
Westminster	12	11	1	12⅛	9⅜

* Ex div., 5s.

More satisfaction falls to holders of telegraph securities. The most active stock throughout the past six months has been the second in the succeeding list.

Stock or share.	Dec. 30, 1905.	Now.	Rise or fall.	1906. Highest.	1906. Lowest.
Anglo Preferred	110	113	+ 3	115½	109½
,, Deferred	17⅜	22⅜	+ 5	27⅞	16⅝
Cuba Submarine	8⅜	8⅜	—	9⅜	8⅛
Direct U.S.	14⅜	15⅞	+ 1½	17	14⅜
Eastern Extension	14⅜	14⅛	— ¼	15⅜	14
Eastern Telegraph	145⅜	142½	— 3	150⅜	142
Great Northern	37⅜	40	+ 2½	41	37¼
Indo-European	58	58½	+ ½	60	56½
Western Telegraph	14	14½	+ ½	15	14

* Ex div., 2s. 6d.

The interest aroused by the recent issue of the National Telephone Co.'s report, and by counsel's opinion as to the probable prices which each security will receive in 1911, justifies setting forth the company's issues at length.

Stock or share.	Dec. 30, 1905.	Now.	Rise or fall.	1906. Highest.	1906. Lowest.
National Telephone Preferred	111	111	—	114⅜	108
,, ,, Deferred	109	110	+1	113⅜	106
,, ,, 1st Pref.	14	12	−2	14⅜	12
,, ,, 2nd Pref.	12	11	−1	12⅛	11⅛
,, ,, 3rd Pref.	5⅜	5⅛	+ ⅛	5⅞	5⅛
,, ,, 3½% Deb.	98½	97½	−1	100⅝	97½
,, ,, 4% Deb.	103½	103	− ½	105½	102⅝

Traction descriptions have attracted a little investment buying this year, but the British Electric Co. has fallen into public disfavour, and the shares show a sharp drop. The "Vanguard" shares have also come down considerably since the beginning of the year.

Share.	Dec. 30, 1905.	Now.	Fall.	1906. Highest.	1906. Lowest.
Anglo-Argentine Ordinary	8½	6¾	— 1⅝	9⅛	6⅞
British Col. Electric Deferred	121½	117½	— 4	122½	115
British Elec. Traction Ordinary	8¼	*5⅝	— 2⅝	8⅝	5
,, ,, ,, Preference	10½	9⅛	— 1⅜	11⅜	8⅞
Cape Electric	1	⅞	— ⅛	1⅛	⅞
London Motor	1⅜	1⅛	— ⅛	1⅜	1⅛
London United Preference	9¼	8	— 1¼	10	7⅞
Metropolitan Electric Preference	1⅛	⅞	— 5/32	1⅛	⅞

* Ex div., 6s.

Lastly, the Miscellaneous list. In this the features are few and insignificant, although they do not carry much comfort for shareholders in the various undertakings.

Share.	Dec. 30, 1905.	Now.	Rise or fall.	1906. Highest.	1906. Lowest.
British Insulated	6¾	6½	— ¼	7¼	6½
British Westinghouse Preferred	2	1⅞	— ⅛	2⅛	1⅞
Callender's	11½	11	— ½	11⅞	10⅝
Electric Construction	⅞	¾	— ⅛	1 1/16	¾
Edison & Swan	1½	1⅜	— 1/32	1⅝	1⅜
Henley's	13	12½	— ½	13¾	12
India-Rubber	18½	17½	— 1	19	17
Telegraph Construction	33	*33½	+ ½	36	32

* Ex div., 12s.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905.	Closing Quotations July 10th.	Closing Quotations July 17th.	Business done week ended July 17th, 1906. Highest	Lowest.	Rise + or Fall —
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	65/-	63/9	..
155,600£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	5 %	£0 — 85 xd	80 — 85	83½	83	..
702,600	Anglo-American Telegraph	Stock	60/6	61s.	23%	31%	65 — 67	65 — 67	..	..	..
8,148,700	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5%	6 %	112 —113	112½—113½	113⅜	112½	+ ½
8,148,700	Do. do. do. Deferred	Stock	1/-	2s.	Nil	1%	22⅝— 23⅞	22⅝— 23⅞	23 7/16	22 7/16	..
50,000	Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red.	100	..	..	..	..	101 —103	101 —103	..	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	8 %	7⅞— 8¼	7⅞— 8⅛	..	..	..
1,982,856£	Commercial Cable Sting. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	57 — 99	97½— 99½	99	..	+ ½
16,000	Cuba Telegraph	10	6⅔	10 %	5 %	5 %	8¼— 9	8¼— 9	8⅝	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %	17 — 18	17 — 18	17 1/16	..	..
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½— 9	8½— 9	8 1/16	..	..
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..
60,710£	Direct United States Cable	20	3½%	3 %	3½%	4½%	15½— 16	15⅝— 16½	16 1/16	15 1/16	+ ¼
65,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200,R.	100	4½%	4½%	4½%	4½%	99½—100½	99½—101½	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	141 —144	141 —144	143⅝	141½	..
3,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	90 — 92	89 — 91 xd	90⅝	89½	..
1,848,772	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	107 —109	107 —109	107⅞	107½	..
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	14 — 14½	14 — 14½ xd	14⅝	14	..
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105½—107½	106 —108	107½	107½	+ ½
600,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅛	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
180,887	Globe Telegraph and Trust	10	£3	5½%	5½%	5½%	10⅞— 11⅛	10⅞— 11⅛	11 1/16	10 15/16	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	14⅜— 14⅝	14⅜— 14⅝	14⅜	..	..
150,000	Great Northern Telegraph, of Copenhagen ..	10	12½%	15 %	24 %	24%	39½— 41½	39 — 41	..	..	— ½
37,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	13 %	57½— 59½	57½— 59½	59	58	..
251,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1⅛— 1⅜	1 — 1⅛	20/-	..	— ⅛
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	4 %	..	⅜— 1	⅛— 1 1/16	..	..	+ ⅛
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	1/16— 1 1/16	⅛— 1	..	..	— 1/16
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	110 —112	110 —112	111½	110¾	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	107 —109	109 —111	110⅜	108⅜	+2
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	12 — 14	11 — 13	12⅛	12	—1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	11⅛	11	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛— 5½	5⅝— 6	6	5⅞	+ ⅛
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96½— 98½	96½— 98½	98⅛	97½	..
1,689,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½—104½	102 —104	104	102⅝	— ⅛
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6½%	7½%	1 5/16— 1 7/16	1 5/16— 1 7/16	27/6	26/9	..
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	26/6	..	..
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	..	4 %	57 — 99	97 — 99	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	5 %	7¼— 7⅝	7¼— 7⅝	..	..	..
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	..	4½%	101 —104	100 —103	..	..	—1
8,201	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..
70,000	United River Plate Telephone	5	7 %	8 %	8 %	8 %	7 — 7½	6½— 7	6¾	..	— ⅛
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5¼— 5½	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	108 —111	108 —111	110	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	9½— 10 xd	9½— 10	..	..	..
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	Nil	⅜— ⅞	⅜— ⅞	15/-	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 — 102	..	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	5 %	14¼— 14⅝	14½— 14⅝	14 7/16	14 5/16	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	5 %	.. — ..	.. — ..	..	..	..
563,880	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..
84,563	Do. do. 6 % Cum. 1st Pref.	10	7 %*	7 %*	6 %	5 %	6 — 7	6 — 7	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	4½— 5½	4½— 5½	..	..	..
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..

* Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

170,000	Anglo-Argentine Trams, 260,008 to 450,007	5	..	..	8 %	8 %	6⅞— 7	6⅞— 7	7	6⅞	..
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	..	5 %	5 %	5½%	6⅜— 6	5⅞— 6	5 13/16	5 11/16	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	138 —141	138 —141	..	..	..
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	..	5 %	5 %	5 %	102 —104	102 —104	..	..	..
800,000	Babcock & Wilcox, 1 to 580,000	1	..	17 %	20 %	20 %	3⅝— 4	3⅝— 4	79/4½	77/6	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	..	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	..	7 %	7 %	3¾— 4	3¾— 4	78/9	..	..
40,000	Do. do. 7 % Cum. Pref...	5	Nil	Nil	7 %	7 %	6 — 6½	6 — 6½	6 5/8	6¼	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	6 %	6 %	5¼— 5⅝	5 — 5½ xd	5 1/16	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	4 %	4 %	4 — 4½	4 — 4½	..	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —104	101 —105	102⅝	..	+1
800,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	6 %	115 —118	116 —119	116½	..	+1
800,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	5 %	107 —110	107 —110	..	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	107 —110	108 —108 xd	106	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	103 —105	103 —105	..	..	..
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	103 —106	101 —104 xd	104⅜	..	..
138,301	British Electric Traction	10	8 %	6 %	6 %	3 %	5⅛— 6	5⅜— 5⅝ xd	5 11/16	5 9/16	..
131,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %§	9 — 9¼	8¾— 9⅛	9⅛	9	— ⅛
1,415,422£	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	109 —113	109 —113	112	110½	..
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	4½%	89 — 92	89 — 92	90⅛	..	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %	6¼— 7	6¼— 6⅝	6 5/16	6¼	— ⅛
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾— 6¼	5¾— 6¼	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	..	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	1⅛— 1⅜	1⅛— 2	30/-	26/10½	+ ⅜
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	..	4 %	4 %	4 %	77 — 83	77 — 83	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	¹⁵/₁₆— 1 1/16	¹⁵/₁₆— 1 1/16	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	2½%	⅜— ⅝	⅜— ⅝	15/-	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	6 %	1⅝— 2	1⅝— 2	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	82 — 84	82 — 84	..	..	..
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	3 %	2 5/16— 3 5/16	3 5/16— 3 7/16	67/6	..	..
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	6 %	5⅛— 5¾	5⅛— 5⅝	..	..	..
27,500	Do "B" do. 1 to 27,500	5	..	6 %	6 %	6 %	5 — 5½	5 — 5½	..	..	..
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	104 —106	104 —106	..	..	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..
105,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	8 %	8 — 8½	8 — 8½	8¼	8¼	..
32,610	Do. 105,001 to 137,610	5	..	..	..	8 %	7⅞— 8¼	7⅞— 8¼	8¼	..	..
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4½%	4½%	102 —104	102 —104	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	15%	10½— 11½	10½— 11½	10⅞	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5⅞	5⅝— 5⅞	5⅞	5 13/16	..
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	108 —110	109⅜	108	+ ½
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %§	⅝— ¾	⅝— ¾	..	..	..
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	6 %	1 3/32— 1 5/32	1 3/32— 1 5/32	22/-	21/6	..
230,211	Do. do. 4½ % 1st Mort, Deb. Stock	100	..	4½%	4½%	4½%	97 —102	97 —102	..	..	..
1,939,698	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	86 — 88	87⅛	86	+1
530,316	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..
530,316	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	74 — 77	74 — 77	..	..	..
1,480,000	City and South London Railway	Stock	3½%	2⅝%	2½%	1⅞%	41 — 43	42 — 44	44	42	+1
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	2½%	2½%	..	1 11/16— 1 13/16	1 11/16— 1 15/16	..	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	94 — 97	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends. ‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 10th.	Closing Quotations July 17th.	Business done week ended July 17th, 1906.		Rise + or Fall—
		†	1902.	1903.	1904.	1905.			Highest	Lowest.	
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	..	10 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	..	6 %	6 %	6 %	1 1/4 — 1 5/16	1 1/4 — 1 5/16	..	..	..
294,150	Do. do. 4½ % Deb. Stock	100	..	4½ %	4½ %	4½ %	103 —106	103 —106	..	..	..
60,000	Dublin United Trams. (1896), 1 to 60,000	10	..	5%	6 %	6 %	13 3/4 — 14 1/4	13 3/4 — 14 1/4	..	..	..
59,987	Do. 6 % Pref. between 1 and 60,000	10	..	6 %	6 %	6 %	14 — 15	14 — 15	..	..	..
800,000	Do. 3½ % "A" Debs.	100	..	3½%	3½%	3½%	95 —100	95 —100	..	..	..
800,000	Do. 3½ % "B" Deb. Stock	100	..	3½%	3½%	3½%	94 — 96	95 1/4 — 96 1/4	..	..	+1
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	Nil	2 5/8 %	..	1 1/8 — 1 1/2	1 1/8 — 1 1/2	..	..	..
17,189	Do. "A" shares, 01—017,189	5	Nil	Nil	2 5/8 %	..	2 1/2 — 3	2 1/2 — 3	..	..	..
844,023‖	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..
100,000‖	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	90 — 95	90 — 95	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	Nil	3/8 — 1/2	3/8 — 1/2	..	..	..
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390	2	7 %	7 %	7 %	7 %	2 — 2 1/2	2 — 2 1/2	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	88 — 91	86 — 89 xd	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9 — 9 1/2	9 — 9 1/2	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	93 — 97	93 — 97	..	..	..
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	..	3 %	4 %	4 %	3 1/4 — 3 3/4	3 1/4 — 3 3/4	75/-	70/-	..
96,000	Greenwood & Batley 7 % Cum. Pref.	10	..	7 %	7 %	7 %	10 1/2 — 11 1/2	10 — 11	..	..	— 1/2
80,000	Do. do. 5 % Mort. Debs.	100	..	5 %	5 %	5 %	101 —102	101 —102	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	15%	12 — 13	12 — 13	12 11/16	12 1/2	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 1/2 — 5 3/4	5 1/2 — 5 1/2	..	..	..
41,978	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	108 1/2	..	..
108,022	Do. do. Scrip. All paid	..	..	..	..	..	107 —109	107 —109	108 1/2	..	..
60,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10%	5 %	10%	17 — 18	17 — 18	17 1/4	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	12½%	12½%	Nil	1 1/2 — 1 3/4	1 1/2 — 1 3/4	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	4 — 6	4 — 6	..	..	..
600,070	London United Trams (1901), 1 to 50,007	10	..	8 %	6 %	3 %	8 — 8 1/2	8 — 8 1/2	8 1/2	8 1/16	..
399,930	Do. do. 60,008 to 100,000 (£6 paid)	10	..	8 %	6 %	3 %	4 — 5	4 — 5	..	..	..
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	..	5 %	5 %	5 %	7 3/4 — 8 1/4	7 3/4 — 8 1/4 xd	7 13/16	..	..
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	94 — 97	94 — 97 xd	..	..	..
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	3 %	1/8 — 1/4	1/8 — 1/4	..	..	..
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/16 — 1 1/16	15/16 — 1 1/16	17/6	..	..
350,000	Do. 4½ % Deb. Stock Red.	100	..	..	4½%	4½%	100 —102	100 —102	..	..	..
20,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	5	..	..	6 %	6 %	4 1/2 — 5 1/2	4 1/2 — 5 1/2	5 1/32	..	..
24,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	10	..	5 %	5 %	4 %	6 3/4 — 7 3/4	6 3/4 — 7 3/4	..	..	..
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	..	5 %	5 %	5 %	7 3/4 — 8 1/2	7 3/4 — 8 1/2	..	..	..
245,000	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	100 —103	100 —103	..	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	15 %	32 1/2 — 34 1/2	32 1/2 — 34 1/2 xd	34	32 3/4	..
150,000‖	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	94 — 96	93 — 95	..	..	—1
540,000	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3½%	100 —103	100 —103	100	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	8½%	3 %	Nil	Nil	1 — 1 1/2	1 — 1 1/4	25/-	..	..
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	Nil	Nil	2 3/4 — 3 1/4	2 3/4 — 3 1/4	62/6	..	..
246,806	Do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	78 — 83	78 — 83	..	..	..

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	..	5 %	5 1/8 %	4 5/8	5 1/8 — 5 3/8	5 1/8 — 5 3/8	..	..	..
50,000	Do. do. 4½ % 1st. deb. stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 3/4 — 8 1/4	7 3/4 — 8 1/4	..	..	..
800,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	102 1/2	..	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	5 %	4 — 5	4 — 5	..	..	..
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4 1/2	4 — 4 1/2	90/-	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3 3/4 — 4 1/4	3 3/4 — 4 1/4	..	..	— 1/8
40,000	Do. do. 1903	5	..	4½%	4½%	4½%	3 7/8 — 4 1/4	3 7/8 — 4 1/4	3 3/4	3 11/16	— 1/8
420,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	101	..	..
44,436	Chelsea Electricity Supply, Ord.	5	4½%	5%	6 %	6 %	5 1/4 — 5 3/4	5 1/4 — 5 3/4	..	..	..
175,000‖	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	6 %	10 3/4 — 11 1/4	10 — 10 1/2 xd	10 5/16	..	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11 1/4 — 12 1/4	11 1/2 — 12 1/2 xd	..	..	..
400,000‖	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	122 —125	124	123 1/2	+1
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102 xd	..	..	..
40,000	County of Durham Electrical Power, Ord.	2	4 %	4 %	£3 7 0	4 %	2 1/8 — 3 1/8	2 1/8 — 3 1/8	..	..	..
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	5 — 5 1/2	5 — 5 1/2	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4 1/2%	5 %	8 — 9	8 — 9	..	..	..
80,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	11 1/2 — 12 1/2	11 1/2 — 12 1/2	12	11 1/2	..
400,000‖	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	106 —109	..	..	—1
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	4 %	3 1/2 — 4 1/2	3 — 4	..	..	— 1/2
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	6 %	4 1/2 — 5	4 1/2 — 5	..	..	..
320,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	103 —106	100 —103 xd	..	..	..
10,000	Folkestone, 1 to 10,000	5	..	5%	5%	5%	5 1/8 — 5 3/8	5 1/8 — 5 3/8	..	..	..
10,000	Do. 6 % Cum. Pref., 1 to 10,000	5	..	..	..	5 %	5 — 5 1/4	5 — 5 1/4	..	..	..
75,000	Do. 4½ % 1st. Deb. Stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
13,000	Hove, 1 to 13,000	5	..	8½%	8½%	9 %	7 1/4 — 8 1/4	7 1/4 — 8 1/4	..	..	..
10,000	Do. New (£6 10s. paid)	£3	..	8½%	8½%	9 %	7 — 7 1/2	6 3/4 — 6 3/4	..	..	— 1/2
87,800	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	96 — 99	99 —101	..	..	+2 1/2
7,800	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	96 — 99	99 —101	..	..	+2 1/2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12%	12 %	10 %	10 — 11	10 — 11	..	..	..
90,000	Do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	4 %	2 — 2 1/2	2 — 2 1/2	40/7 1/2	..	..
60,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5 1/2	5 — 5 1/2	..	..	..
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	98	..	..
200,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8½%	10 %	10 %	8 1/2 — 9 1/4	8 1/2 — 9 1/4	8 13/16	8 5/8	..
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	4½%	5 1/16 — 5 1/16	5 1/16 — 5 1/16	5 5/8	..	..
220,000‖	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	109 —113	109 —113	..	..	..
250,000‖	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	94 — 96	94 — 96	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..
75,000	Newcastle-on-Tyne, 1 to 75,000	5	..	8 %	8 %	8 %	7 3/4 — 8 1/4	7 3/4 — 8 1/4	..	..	..
75,000	Do. 5 % Pref., 1 to 75,000	5	..	5%	5 %	5 %	5 1/4 — 6 1/4	5 1/4 — 6 1/4	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	7½%	13 1/2 — 14 1/2	13 1/2 — 14 1/2	..	..	..
64,000	Do. do. 4 % 1st Mort.Deb.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..
18,500	Oxford, 1 to 96 and 407 to 18,810	5	..	6½%	7 %	7 %	6 3/4 — 6 7/8	6 3/4 — 6 7/8	..	..	..
50,000	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	99 —101	97 — 99	..	..	—2
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	12½%	10 1/4 — 11 1/4	10 1/4 — 11 1/4	10 5/8	..	..
20,000	Do. do. 7 % Pref. 20,061 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..
150,000‖	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	95 — 97	95 — 97	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	4 %	2 — 2 1/2	2 — 2 1/2	..	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	12½%	3 %	4 %	4 %	2 3/4 — 3 1/4	2 3/4 — 3 1/4	..	..	..
103,700	South Met. Elec. Lt. & Power (Ord.	1	Nil	Nil	Nil	2½%	3/4 — 7/8	3/4 — 7/8	..	..	..
85,368	*(Late Blackheath and Greenwich* 7 % Pref.	1	Nil	7 %	7 %	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..
148,292	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..
50,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3 3/4 — 4 1/4	3 — 4	..	..	— 1/8
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4 1/2 — 5	4 1/2 — 5	..	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	4½%	100 —102	100 —102	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13 %	10 1/2 — 11 1/2	10 1/2 — 11 1/2	11 1/2	10 3/4	..
28,151	Do do. 4½ % Cum. Pref. (Originally 5 %—Red. to 4½ % from 31st Dec., 1905.)	5	5 %	5 %	5 %	5 %	5 1/4 — 5 1/2	5 1/2 — 5 3/4	5 3/4	5 11/16	..

Shares not officially quoted :—Mackay Companies, ord., 73—75. Pref. 74—76.
† Unless otherwise stated all shares are fully paid. ‖ Interim dividends.

(Bank rate of discount 3½ per cent. June 21st, 1906).

INTERFERENCE IN WIRELESS TELEGRAPHY AND THE INTERNATIONAL TELEGRAPH CONFERENCE.

BY R. A. FESSENDEN.

(*Continued from page* 78.)

RESULTS ACTUALLY OBTAINED.

1. *As Shown by Official Reports.*—Test made by Wireless Telegraph Board, August 29th, 1904. (Using old type interference preventer.) Locations of the stations referred to in this test are shown in the diagram, fig. 11.

S A is the Highlands station. R A is the Navy Yard station at Brooklyn, distant 24 miles from the Highlands. D A is the interfering station on board the *Topeka* at Tompkinsville, distant 5½ miles from the Navy Yard station. This station was also used as an intercepting station during

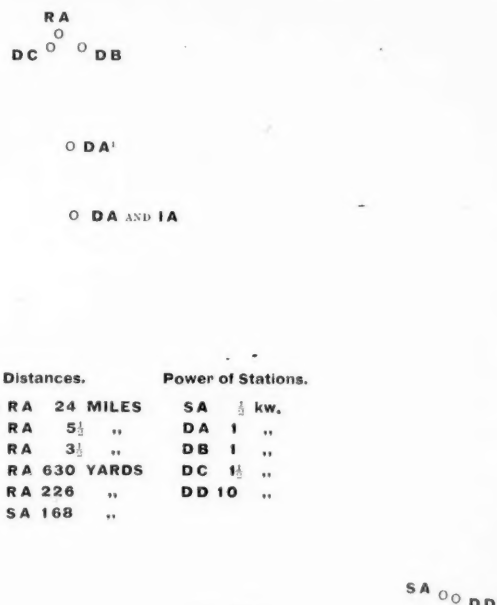


FIG. 11.

the trial of the secrecy sender. D B is an interfering station on board the receiving ship *Hancock* at the Navy Yard, distant 630 yards from the Navy Yard station R A. D C is an interfering station at Building No. 75, distant 226 yards from the Navy Yard station R A. D D is an interfering station 168 yards distant from the Highlands station.

The stations R A and S A were about ½ KW. (375 watts) each. The stations D A and D B were somewhat over 1 KW. The station D C was run up above 1½ KW. until the fuses blew. The exact current was not taken. The station D D was approximately 10 KW.

The heights of the antennæ were about 220 ft. for station D D, 150 to 175 ft. for stations S A and R A, about 135 ft. for station D A, and about 120 ft. for stations D B and D C.

Stations D A, D B and D C differed very nearly 10 per cent. from the wave-length used by station S A. The wave-length of station D D was not measured, but it was somewhat longer than the other stations.

REPORT.

95. Besides the usual sending and receiving apparatus, the following instruments were presented for test: interference preventer and secrecy sender. The installation at the Highlands station was the same as at the Navy Yard, except that, instead of using that station ground, a "wave chute" (capacity) was fitted, consisting of about a mile of bare wire laid in the form of a large net on the ground, and in contact with it.

96. The progress for the test between the stations at the Navy Yard and the Highlands was as follows:—

1. Transmitting and receiving for accuracy and speed.
2. Interference test.
3. Test to determine if message transmitted by secrecy sender could be intercepted.
4. Test to determine if messages could be received and sent between two stations, one equipped with the Slaby-Arco and the other with the Fessenden apparatus.

97. The rules governing the test were as follows:—

No dispatch to be longer than 10 minutes.

Navy Yard to use the first and third quarters of the hour.

Highlands to use the second and fourth quarters of the hour.

Absolutely no messages or signals to be sent by either station during the time assigned to the other station—not even an acknowledgment.

Every message, official or otherwise, must be recorded in the book provided for the purpose. The time of beginning and ending of every message must be recorded in the book.

The results of the test for speed are of no particular interest here. The following may, however, be quoted from that part of the report:—"The reception at the Navy Yard was very good. One message of 85 words was received with the loss of one word, at the rate of 26 words per minute. Another message of 135 words was received at the rate of 27 words per minute, with the loss of four words."

100. At 10 p.m. the Board adjourned until 10 a.m., August 30th, when it met to make the interference test. Captain Rodgers and Lieut. Edgar at the Navy Yard station; Commander Peters and Commander Fiske at the Highlands station; Lieut.-Commander Jayne, on board the *Topeka*. From 10.23 to 10.57 a Press dispatch of 861 words was received from the Highlands at the rate of 20 words per minute, with the loss of two words in the headline and two mistakes in the text. During this time, until 10.45, with the exception of intervals of a few minutes, the *Topeka* was interfering continuously. The *Topeka* was anchored off Tompkinsville, 5½ miles distant from the Navy Yard station.

101. From 11.27 until noon, the receiving ship *Hancock* at the Navy Yard, 630 yards distant from the Navy Yard station, and the experimental station in building 75 at the Navy Yard, 226 yards from the Navy Yard station, interfered continually. During this period the reception from the Highlands was not good, one message being received with the loss of one word in three.

(*Note.*—The loss of one word in three referred to in Section 101 was due to the fact that the company had been informed that the interference test would be made with stations several miles away. Consequently, this severe interference from these near-by stations was entirely unanticipated, and the apparatus had not been tuned up as carefully as it would have been had the test been expected. During the noon recess, the apparatus was tuned up more carefully with improvised apparatus, and gave the results shown in Section 102. No opportunity was, however, given to install such closely selective apparatus as would have been used had the character of the test been known beforehand.)

102. At noon the Board took a recess until 2.15, then met, and continued the test for interference. The station at building 75 interfered from 2.15 until 3 p.m. During this period the average loss was 1 word in 12, in a message sent from the Highlands. From 3·15 to 3.45 the secrecy sender was tested. A message of 362 words was sent from the Navy Yard station to the Highlands by a Navy operator, at the rate of 13 words per minute (Continental Morse) with a secrecy sender. The *Topeka* had instructions during this period to read the message if possible. The *Topeka* was able to receive five continuous words of this message, after adjusting the receiver tentatively to do so.

It will be seen from this report that the interference preventer used at station R A was able to work even through interference from station in building No. 75, only 226 yards away.

The interference preventer installed at the Highlands was, however, unable to cut out malicious interference from the 10-KW. station D D, 168 yards away. When the interference preventer was not used, and the interfering station D D was operating, sparks from ¼ to ½ in. in length passed between the various circuits on the receiving apparatus. When the interference preventer was used, however, the sparking was entirely cut out, and occasional words could be heard from the Navy Yard station, but it was impossible with the apparatus then installed to cut out the interference so as to permit of practical working. It is believed, however, that were the test to take place again, with the improved types of interference preventer now used, no difficulty would be met with in reading through such interference.

With reference to the test of the secrecy sender, it should be pointed out that the difference in wave-length used was approximately 10 per cent. At the present time the difference in wave-length used is only one-quarter of 1 per cent.

Test made by Bureau of Equipment, March —, 1905.
(Using old type interference preventer.)

Address Bureau of Equipment, Navy Department,
and refer to No. 110,586. Washington, D.C.,
April 7th, 1905.

Enclosures,
LAK. . . ALC,
Gentlemen :

1. Referring to your communication of the 5th inst., requesting information as to results obtained with your apparatus by Lieut. Hudgins, the Bureau quotes from that officer's report as follows:

(*a*) "The interference preventer will practically exclude any wave varying in length by as much as 3 per cent. from the wave to which the preventer is adjusted, provided the intensity of such interfering wave is not greater than that of the wave to be received. As the interfering wave increases in relative intensity, the difference in wave length must be increased also. Unless very accurately adjusted, the interference preventer absorbs part of the strength of the wave and the more imperfect the adjustment the greater the absorption. The adjustment of the interference preventer is somewhat difficult, but once made, it is practically constant."

(*b*) "With this connection it is possible to absorb or shunt to earth waves so strong that close connected they will burn out the receiver, and at the same time to build up a weak resonant wave to sufficient strength to be read. A variation of 10 per cent. in wave length has been found sufficient to cut out waves so strong that they could not be received direct either on the electrolytic or coherer receivers, while at the same time a weak wave which the coherer would just record was plainly received on the telephone. With waves of more nearly equal intensity a variation of 3 per cent. in length is ample."

(*c*) "With atmospheric or other interference the electrolytic receiver is the better, the sharp degree of tuning practicable with this receiver permitting the tuning out of other stations, unless very close to the same wave length or else much stronger than the wave which it is desired to receive. Atmospheric disturbances pass through the electrolytic receiver with a distinctly characteristic sound, and unless very numerous or strong enough to burn out the fine point in this receiver, do not materially interfere with the reception of a message coming in at the same time."

Very respectively,
H. M. Manney,
Chief of Bureau of Equipment.

National Electric Signalling Co.,
8th and Water Sts., Washington, D.C.

Test made by U.S. Coast Artillery, June 14th, 1905.
(Using old type interference preventer.)

On two occasions during the exercises we had an opportunity to severely test the value of the device provided to prevent interference. One of the attacking vessels, the *Texas*, is equipped with a wireless plant of large capacity. During the attack on the nights of June 14th and 15th, beginning at a distance of about 12,000 yds. and continuing until near the end of the phase, the operator on the *Texas* made every effort to confuse and break our messages, by keeping his transmitter key closed continuously for long periods. As our "interference preventers" had been in place but a few days they had not been perfectly adjusted, and the operators were not entirely familiar with their use. The attempt of the *Texas* was partially successful on June 14th, and our messages were broken during the first half hour of the attack, but further adjustment enabled the operators to send and receive successfully. On the night of June 15th the attempted interference on the part of the *Texas* was a complete failure. Both operators assured me that they succeeded in cutting out the interfering waves almost completely, and that they experienced no difficulty sending or receiving.

Very respectfully,
(Signed) I. N. Lewis,
Captain, Artillery Corps,
Instructor, Dept. Electricity.

Test of ½-kw. Outfit on U.S.S. *Alabama* and *Illinois*, August 2nd, 1905.

Private Report of Lieut. Hudgins, *August 2nd*, 1905.
(Old type of interference preventer.)

Bar Harbour, Me., *August 5th*, 1905.

My dear Mr. Davis.

Just an hour before sailing from New York on the 1st inst. I received signal from Commander-in-Chief ordering me to report on board *Illinois* during the run to this port, and make a test of Fessenden apparatus. Knowing it would be impossible for you or your operators to get on board within the hour, I went ahead, and did the best I could, signalling Gallagher a few cautions as to cleaning spark gap and commutator, and leaving him to look out for *Alabama*, I took charge on the *Illinois*. We had the test on the next day, August 2nd, and forenoon of the 3rd, and in spite of considerable interference from a number of our Morse friends using the Navy tune, several inquisitive naval ships and stations, and so many other stations, that we had to keep the interference preventer on all the time, we managed to carry the *Alabama* without mishap for 268 miles. During the test we got calls, vs, messages, ?, &c, from stations signing "Al," "Ba," "Wa," "Cj," "Hj," "Cs," "Sj," "Pi," "Pg," "Hg," "Lc" and "Pk," and some of them were so busy that the operators thought they were working overtime.

Very sincerely yours,
J. M. Hudgins.

Note.—Had the stations referred to in the above letter as using the Navy tune been *exactly* on the Navy tune they could not, of course, have been cut out. The fact that they were cut out is to be explained by the fact that the wavemeter used by the Navy Department for tuning its vessels did not read closer than 5 per cent., and as the old type interference preventer cut stations out entirely, which differed by only 3 per cent., it was thus possible for the *Alabama* to cut out one Navy station and listen to another at will, though all the Navy stations were *supposed* to be tuned to the same frequency.

Letter of Navy Operator, U.S.S. "Illinois," January 15th, 1906.
(Old type interference preventer used.)

U.S.S. *Illinois*,
Hampton Roads, Va.,
January 15*th*, 1906.

I would like to ask you if you had heard anything of us since we left Boston and came here, as you undoubtedly know we are installed with the Fessenden set, and we have been sending and receiving official messages between here and Boston Navy Yard, and have communicated with Portsmouth, and although have not reached Cape Elizabeth, Me., we have at times heard them very plain. We talk with P.G. (Navy Yard, Boston) and P.C. (Navy Yard, Portsmouth) every night between 12 and 4 a.m., and have also received and sent messages to Newport and Nantucket. We use a spark $\frac{5}{16}$ in. on each side of the cooling plate, and spark points $\frac{3}{8}$ in. in diameter, and about 30 ampere to talk to these people, and they seem to get us very good. *We talked with Newport through a lot of merchant interference with the use of the interference preventer*, it serving its purpose well in this case.

Note.—The distance from Hampton Roads to Newport is 410 miles, and from Hampton Roads to Portland, Me., 580 miles.

Report of Navy operator, U.S. Navy Wireless Telegraph Station, Newport, March 24th, 1905.
(Old type of interference preventer used.)

U.S. Navy Wireless Telegraph Station,
Newport, Rhode Island,
March 24th, 1905.

This is to certify that the interference preventer as arranged by Mr. Chas. J. Pannill, of the National Electric Signalling, to my personal observation cut out the following stations absolutely:—Cape Cod, Fort Wright, New Haven, Marconi boats, as well as their Siasconsett station, Jersey City, the Fall River boats, *Priscilla* and *Pilgrim* (about a half hour after sailing from Newport), moderate atmospheric, also terrific atmospheric reduced about 50 per cent., and received Nantucket Shoals Lightship without decreasing her signals, but on the other hand, increasing them as compared with receiving them on . . . . apparatus installed at this station. All the above stations, excepting Jersey City, which we do not get on . . . . apparatus, interfere with our receiving from Nantucket Shoals Lightship.

On Saturday, March 18th, I received signals from the Fessenden Jersey City station, which were very distinct.

The atmospheric disturbances were so severe one night last week, I was not able to receive the report of a passing steamer from the Lightship on the . . . . apparatus, but upon changing over to the Fessenden interference preventer, the terrific atmospheric was cut down to such an extent that I was enabled to receive the report without any trouble.

Note.—This report is not correct as regards the amount of atmospheric cut out. Even with the old type of interference preventer, the atmospheric disturbance was cut down more nearly to 1 per cent. than 50.

The interference preventer used in the above tests is not, with two exceptions, installed on the ships of the U.S. Navy. Tenders were asked for, but as the Navy had declined to recognise the six decisions of the U.S. Courts determining the ownership of the liquid barretter, and was continuing to purchase these receivers from infringing companies, the owners of the patents declined to furnish interference preventers for use with the infringing apparatus, on the ground that a man who has stolen an automobile has no moral right to expect the owner to supply him with gasoline.

For some reason or other the efforts of the infringing companies to build interference preventers have not been successful, possibly because its efficiency depends very largely upon the correct proportioning of the electrical constants, and the infringing companies do not seem to be provided with apparatus for making exact measurements of high frequency currents.

(*To be continued.*)

THE COLLIERY EXHIBITION.

(*Concluded from page* 38.)

The Diamond Coal-Cutter Co. had various types of machines on view, including compressed air coal-cutters. The electrical machines are arranged for either continuous-current or three-phase motors, and for either one or two motors. Several chain type machines were exhibited. In the two-motor chain cutter, shown in fig. 5, the chain is

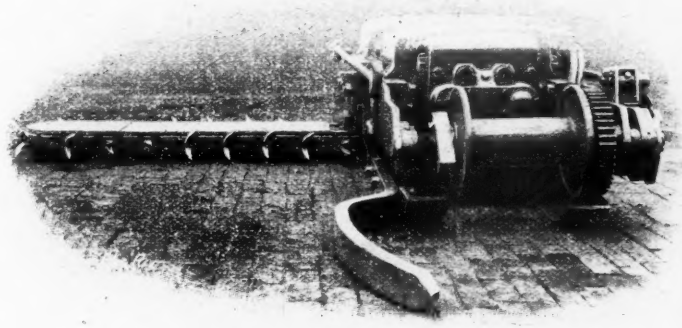


Fig. 5.—"Diamond" Two-Motor Chain Coal-Cutter.

extended under the machine, so as to deliver the cuttings or "holing dirt" on the goaf side, while the single-motor chain machine is adapted for "cutting in," thus avoiding the necessity for making a machine "stall" or "stable." It is necessary, however, either to "flit" or turn the machine round, as, unlike the two-motor chain machine, it will not cut in both directions. A single-motor disk machine is shown in fig. 6. The same firm had also a number of "hand" and electric coal drills. Of the latter type a new drill, the "Waterhouse," was shown, as illustrated in fig. 7; it was mounted upon wheels, and appeared to be a really well-designed and substantial machine. As an instance of the work done by this drill, we were informed that at a colliery in a 28-in. seam on a 500-volt circuit, six holes 4 ft. 6 in. deep and 6 ft. apart are being drilled per hour, and that 275 holes have been drilled in 46 working hours at a cost of 1·63d. per hole, against 5d. per hole by hand. The Blackett patent underground conveyor was also shown. This consists of a trough in which a chain conveyor slides, propelled either by electricity or compressed air. The conveyor is set up parallel to the longwall coal face, and when the coal has been brought down after being undercut by the coal-cutter, it is loaded into the trough by hand, and is carried along by the chain and discharged into a tub placed underneath the end of the conveyor, as shown in fig. 8, which shows the tub being filled. After a slice of coal has been taken off, and a new length of face undercut, the conveyor is moved up to the face again, and on this account has to be made as light as possible. Its use not only cheapens the actual cost of getting the coal, but increases the power of production from a given length of face. It may be made any length, but naturally its use and length is governed by mining conditions, such as the strength and hardness of the roof and floor.

The British Westinghouse Electric and Manufacturing Co., Ltd., had a large exhibit of motors, colliery switchgear, pumps, fans, &c. The motors included a three-phase motor, dismantled for the purpose of giving visitors an opportunity to inspect its construction; a direct current totally enclosed motor and a D.C. crane motor. The switches included interesting examples of motor-control pillars which comprise a starting rheostat, shunt-field regulator and double-pole automatic circuit-breaker provided with overload, no-voltage, loose-handle and carbon break attachments, and in the case of large pillars a magnetic blow-out device—all in one strong cast-iron case; oil-immersed switch-type auto-starters, and controllers, switchboard panels with switches fixed to the back of the panel, enclosed with sheet-iron partitions and expanded metal door interlocked with the switches. The pumps exhibited included examples of three-throw pumps by Messrs. Pearn; four-stage horizontal turbine pumps by the Worthington Pump Co., and a centrifugal pump by Messrs. Gwynne, all driven by three-phase motors.

A large Cowans-Sheldon capstan was also shown, driven by a three-phase motor, through worm and spur wheel gearing, the motor shaft being fitted with an automatic brake to prevent the load turning the capstan in the opposite direction. The controller is operated by a foot pedal, and is of the drum type, governing the supply of current to the stator, as well as the variation of the resistance in the rotor circuit. The return of the controller to the "off" position is effected automatically by springs on the pressure by the foot being removed. Two fans were shown, one being a 40 in. "Sirocco" for mine ventilation, direct-coupled to a three-phase motor of 45 H.P. at 480 r.p.m., the capacity of the fan being 66,000 cb. ft. of air per minute, against a 1·5 in. W.G. The other was a 4 ft. diameter "Waddle" fan coupled direct to a 30-H.P. three-phase motor, and when running at a speed of 720 r.p.m. capable of delivering 50,000 cb. ft. of air per minute, against a 2·75 in. W.G. On both fans all the bearings have continuous ring lubrication, and in the case of the "Waddle" fan the bearing is arranged for water cooling if necessary. A small Brotherhood air compressor, coupled direct to a 2-H.P. 110-volt, 1,420 r.p.m. shunt-wound motor, and the Cooper-Hewitt mercury vapour lamps were also shown.

The British Westinghouse Company has also given some attention to the much-debated question of electric winding for collieries, and three drawings were shown of a new arrangement termed the "Westinghouse converter-equaliser system." In this system the winding motor is directly connected to the mains through transformers, whilst a separate converter-equaliser stores energy during the no-load period and restores it to the high tension transmission line during the maximum load or starting period. Generally the arrangement consists of a rotary converter connected to the high-tension transmission lines through transformers. On its direct current side the rotary converter is connected to a separate direct current machine fitted with a fly-wheel, which acts sometimes as a motor and sometimes as a generator. The

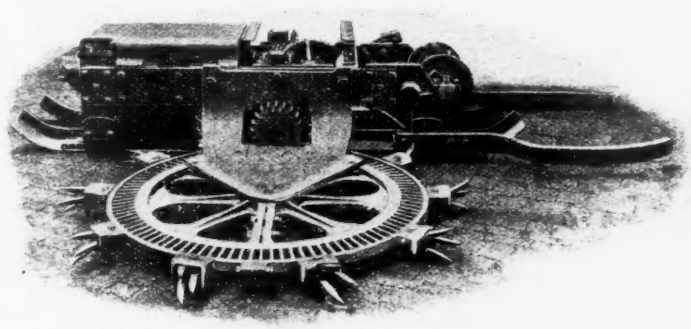


Fig. 6.—"Diamond" Single-Motor Disk Coal-Cutter.

rotary converter is compounded in a special way so as to supply automatically the magnetising currents required for the induction motors on the system, and the voltage of the fly-wheel machine is controlled automatically by a quick-acting regulating apparatus which is actuated from the high tension transmission line through series transformers.

A diagram of the connections is shown in fig. 9, (1) being the rotary converter; (2) transformers; (3) direct-current machine with fly-wheel (4); (5) winding motor and quick-acting regulating apparatus for direct-current voltage. The advantages claimed for this system are that the capacity and, consequently, capital cost are reduced, and, further, as the converter equaliser has only to deal with fluctuations in

the demand, and does not transform the total energy required, the energy loss is also considerably decreased. Another point in its favour from a colliery point of view is that the winding motor can be operated direct from the mains should the converter equaliser for any reason be shut down.

The Brush Electrical Engineering Co. exhibited their Birtley-Falcon coal-cutter, which has recently been

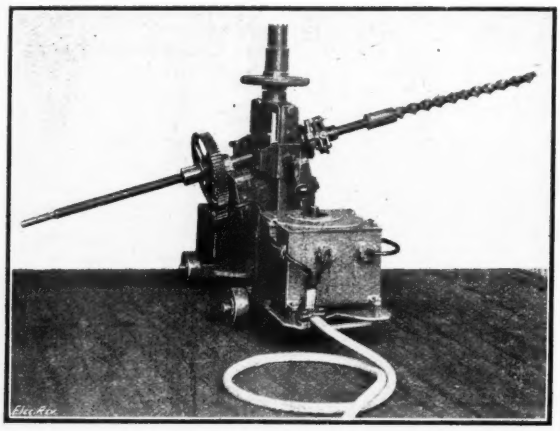


Fig. 7.—The Waterhouse Drill.

placed on the market. This machine has two motors of 15 b.h.p. each, capable of withstanding an overload of 100 per cent. for short periods, and controlled by a traction type of series-parallel controller fitted with blow-out coils. The resistances are of the cast-iron grid type, and the switch is generally designed to be as far as possible "fool-proof," and to stand rough usage, which is practically inseparable from coal-cutter work. The motors may be either three-phase or continuous current, and are so arranged as to be interchangeable on the frame. The feed mechanism is specially interesting, and consists of an eccentric keyed to the pinion shaft driving the cutter wheel, the eccentric rod being connected to a sliding block in a link, which operates the pawls on the rope drum ratchet gear. The link block is suspended, and by means of rods and worm gear may be moved up or down, thus increasing or decreasing the amount of feed, or, in fact, taking off the feed altogether. Both starting switch and feed gear may be operated with equal facility from either end, and the feed may be varied from zero to full notch while the machine is in motion. The machine is mounted upon skids, but the "face"

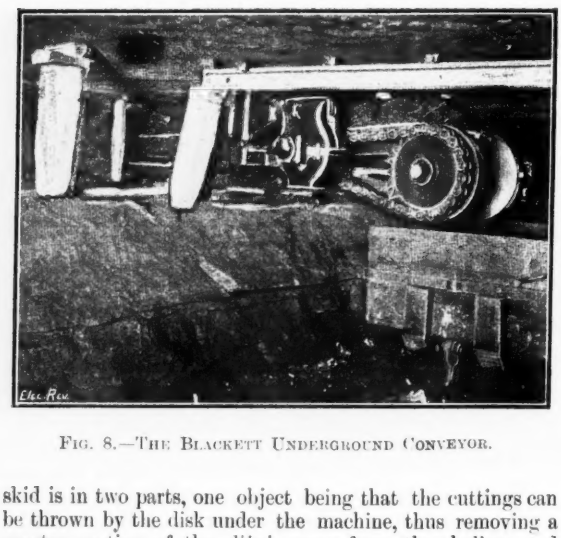


Fig. 8.—The Blackett Underground Conveyor.

skid is in two parts, one object being that the cuttings can be thrown by the disk under the machine, thus removing a greater portion of the *débris* away from the holing, and further, the skid is "edge" on the floor, which gives it a better hold and prevents the machine being thrust away from the face, thus reducing the weight against the timber on the goaf side of the machine, although a fender is provided to take this thrust. The motors drive through worm gearing, the worm being of steel and the wheel of special phosphor-bronze, working in a dust-proof and gas-tight oil bath. It is a massively constructed machine, and the only possible objection that can be taken to it is its somewhat heavy weight, which, however, may be reduced by lightening some of the parts, as experience may show some of these to be unnecessarily strong.

Other exhibits by this company included one three-throw and one centrifugal pump, both by Messrs. Hathorn & Davy, driven by 17-b.h.p. and 25-b.h.p. Brush direct current motors respectively, and a 300-kw. air-cooled step-down transformer from 5,500 volts to 300 volts; motor-starters, &c.

The importance of electrically driven air compressors for underground work, whereby the air is compressed close to the point where it is to be used, is now becoming recognised, and one or two makers showed their machines mounted on wheels for "pushing about inbye." At best it is only a makeshift, due mainly to the want of a good percussive electric drill. Once such a drill is on the market, compressed air plant will be cheap, but until then electricity and compressed air is not a bad combination, as was amply demonstrated on Messrs. Reavell & Co.'s stand. The Reavell machines are now extensively used underground, and are made in many

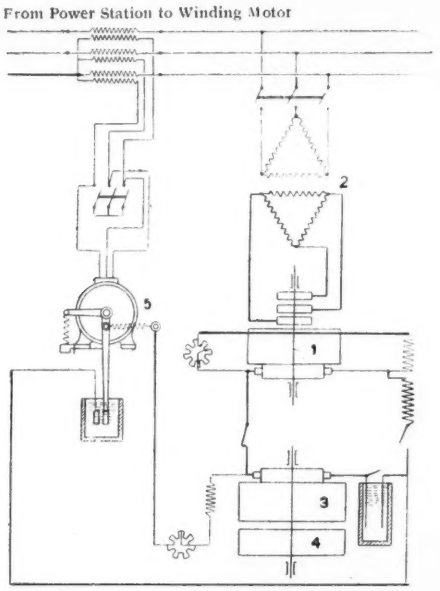


Fig. 9.—Diagram of Connections of Westinghouse Converter-Equaliser System.

forms and sizes. Three machines were shown, one capable of dealing with 270 cb. ft. of air, coupled to a three-phase 50 b.h.p. motor running at a speed of 325 r.p.m. and compressing, in two stages, air up to 100 lb. pressure. This machine is fitted with an intercooler. Another machine, single-ended coupled direct to a 24-b.h.p. motor, with a capacity of 120 cb. ft. compresses up to 80 lb. per sq. in. when running at a speed of 275 r.p.m.; while the third machine was of the gear-driven, single-stage duplex or tandem type. The advantage of these machines is that no air receiver is required, and they are usually provided with an automatic speed regulating apparatus for the motors, which is controlled by the air pressure. The latest improvements consist in arranging the delivery valves so that they may be easily and separately removed from the outside by means of a spanner without having first to take off a cover, and an automatic arrangement controlling the oil supply, which is cut off as the air pressure falls. The Ingersoll-Rand Co. also showed an electrically driven air compressor, mounted upon wheels, together with an air receiver for the same—also on wheels—for transportation underground; whilst Messrs. W. H. Bailey & Co. exhibited a small motor-driven "Koster" single-stage air compressor, compressing up to 90 lb. per sq. in.

Other exhibits included superheaters, mechanical stokers, &c., Messrs. Paulton & Son's patent curvilinear blocks for the setting of Lancashire boilers deserving special mention, as they merited attention from all interested in the setting of this type of boiler. Other items of interest were the patent flue cones and hollow fire-bars. The cones consist of a conical-shaped cast-iron stand, on which are fixed parabolically curved fireclay lumps, with spaces between. Several of these cones are placed at intervals in the flue, and not only do they break up the hot gases, deflecting them on to the tube plate, but becoming intensely hot they re-ignite the relatively cold gases coming from the furnace when green coal is thrown upon the fire, and the makers assert that a saving of from 8 to 12 per cent. per annum can be effected by their use.

Automatic couplings, life-saving apparatus, safety lamps, including electric safety lamps shown by the Electric Power Storage Co., Ltd.—which class of lamp, by the way, seems to make but little headway, owing principally to the want of efficient means of detecting gas—steel pit props, pipes and tubes, made up an interesting collection of colliery appliances which were well worth seeing.

INACCURATE METERS.

[by our legal contributor.]

From certain letters which have recently appeared in the columns of this journal, it would appear that there is some doubt as to the legal rights of company and consumer in cases where the meter fails to record with sufficient accuracy. Our legal contributor has forwarded the following communication on the subject.

It is a curious fact that the Electric Lighting Acts, 1882 and 1888, make no provision for the examination or certification of meters, except that one of the Sections in the former Act provides that a consumer must place no obstacle in the way of an electric inspector who wishes to enter a consumer's premises with a view to examining these instruments. The legislation with regard to meters is to be found in the Schedule to the Electric Lighting (Clauses) Act, 1899, which is now made part of every provisional order. As to orders made prior to this Act, it may be taken generally that they contain similar provisions: the Schedule in question having been passed with a view to saving constant repetition of common form provisions in the numerous private Acts which were passed from time to time for the confirmation of provisional orders.

The Schedule provides that the amount of energy supplied by the undertakers to any ordinary consumer or the electrical quantity contained in the supply (according to the method by which the undertakers elect to charge) shall, except as otherwise agreed between the consumer and the undertakers, be ascertained by means of an appropriate meter duly certified. A meter is considered to be duly certified if it is certified by an electric inspector to be a correct meter, and to be of some pattern, and to have been fixed and to have been connected with the service lines in some manner approved by the Board of Trade. If any alteration is made in the meter, or it is unfixed or disconnected, it must be recertified.

Where the value of the supply is to be ascertained by meter, the undertakers must, if so required, supply and fix an appropriate meter, provided that prior to supplying any such meter they may require the consumer to pay them a reasonable sum in respect of the price of the meter, or to give security therefor, or may require him to enter into an agreement for the hire of the meter, at a rent to be fixed, in case of dispute, by the Board of Trade. If the meter belong to the consumer, he must at all times at his own expense keep it in proper order for correctly registering the value of the supply, and in default of his doing so the undertakers may cease to supply energy through the meter.

The undertakers may have access to, remove, test and inspect any such meter at reasonable times.

The reasonable expenses of and incident to any test, &c., must, if the meter is found not to be in proper order, be paid by the consumer; but if it is found to be in proper order, all expenses connected therewith must be paid by the undertakers.

Where the undertakers hire out a meter to a consumer, they must (unless the agreement otherwise provides) keep it in proper order for correctly registering the value of the supply; and in default of their doing so, the consumer is not liable to pay rent for the meter during such time as the default continues. The undertakers may have access to, and have liberty to remove, any such meter at all reasonable times.

We now come to the statutory provisions in force relating to differences between the undertakers and consumer as to the accuracy of a meter.

It is provided that if any difference arises between any consumer and the undertakers as to whether any meter whereby the value of the supply is ascertained (whether belonging to the consumer or the undertakers) is or is not in proper order for correctly registering that value, or as to whether that value has been correctly registered in any case by any meter, that difference shall be determined upon the application of either party by an electric inspector, and that inspector shall also order by which of the parties the costs of and incidental to the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties.

Subject to this provision, the register of the meter is declared to be *conclusive* evidence (in the absence of fraud) of the value of the supply. It may be mentioned, in passing, that in the case of a gas meter, the register is only *prima facie* evidence of the amount of the gas supplied.

What, then, is the application of this enactment in practice? It amounts to this, that unless the consumer cares to submit his meter for inspection, he is bound by its register of the current consumed. In the case of a large consumer, he may be prepared to pay the costs of inspection; but in the case of a small consumer, whose total electric lighting bill for the year comes to under £5, the prospect of having to pay the cost of an inspection is a serious matter. It is presumed, however, that if the meter in question was the property of the undertakers and was hired out by them, the fact that (in accordance with the provisions above referred to) the duty of keeping the meter in repair was upon them, would operate to induce the inspector to make the undertakers pay the cost of the inspection, whether the meter had exaggerated or minimised the amount of energy supplied.

It is remarkable that in some places undertakers apparently have power to impose special terms upon consumers. In Dublin, for instance, the amount of energy supplied to any ordinary consumer under the Dublin Electric Lighting Order, 1892, is ascertained by means of a meter or meters supplied by the corporation of a pattern and construction approved by the Board of Trade, which must be certified by the chief electrical engineer to the corporation to be in proper working order for correctly registering the amount of energy supplied. No person except an officer of the corporation may fix, connect, or "otherwise interfere" with any meter, all meters being sealed by the corporation. In these circumstances one would have thought that the duty and expense of keeping the meter in repair was on the Corporation, but the general conditions under which the Dublin Corporation supply electrical energy go on to provide that—"Should a consumer dispute his account, he may, upon giving written notice to the Corporation, have his meter specially tested by the Corporation Electric Light Department, and if, on the necessary test being made, the maximum inaccuracy of the meter be found more than 5 per cent., the Corporation will pay the expense of the testing, and will add to or deduct from the consumer's account, as may be necessary. Should the maximum inaccuracy of the meter prove to be less than 5 per cent., the consumer shall bear all the expense of the testing. Subject as aforesaid the register of the meter shall be conclusive evidence, in the absence of fraud, of the value of the supply. Provided always that nothing herein shall be deemed to deprive the Corporation or the consumer of the right to have any dispute as to the correctness of the meter determined in accordance with the

provisions of the Dublin Electric Lighting Order, 1892. Those provisions are probably similar to the provisions of the Schedule to the Act of 1899 to which we have alluded. But it is further provided by the Dublin Electric Lighting Order, 1892, that any ordinary consumer may specially require the Corporation to supply him with a meter officially certified by an electric inspector appointed by the Board of Trade, but the consumer must in such case pay a special maintenance charge of 5s. per quarter to cover the cost of regular inspection, in addition to the ordinary charge for meter rent made by the Corporation.

The question then arises: Assuming that the meter has registered incorrectly, what are the rights of the undertakers? Assume, for instance, that the register has remained stationary for an entire quarter, in strictness the consumer should be charged nothing, particularly when, as in the case of a hired meter, it is the duty of the undertakers to keep it in repair. Cases have often occurred in which the meter has registered a consumption out of all proportion to the amount usually consumed, and consumers have successfully resisted payment of anything more than an average charge. It is not known, however, whether any case has occurred in which undertakers have successfully preferred a claim where the dial of the meter registered an amount which was far below the average. As a general rule, an amicable arrangement is come to.

A recent case at the Dover Police Court, which was heard on July 6th, 1906, illustrates the fact that a consumer who disputes the accuracy of a meter should take steps to have it rectified in the orthodox way. The defendant was summoned for the supply of electricity to his premises for the six months prior to March 31st, amounting to £59 3s. 6d. It appeared that upon his refusal to pay, the Dover Corporation offered to test the meter, but he refused this. It came to light in the course of the case that if all the lights were on the meter would run at half load, and register about 4·8 units per hour. The meter would carry 10 units. A witness stated that "experience showed that when the meters run half load, they register low. The lesser the amount of consumption, the lower they registered." Upon this the Chairman said it raised a very serious question. According to the evidence of the Corporation itself the meters were incorrect. Later on, however, he was apparently convinced that the defect in question could be remedied by cleaning, and finally made an order for the defendant to pay the full amount, less discount.

Whatever may be the legal rights of the parties in relation to this question, it is clear that where a consumer complains of an overcharge and has his meter tested, in accordance with the terms of the provisional order, he is liable to pay the cost of the test if the meter should prove to be correct, and it is submitted that he would have to pay for all the energy which is recorded to have been consumed by the meter.

THE RECENT TRAMWAY ACCIDENTS.

Liverpool, Swindon, Highgate and Halifax have become within the last few months names of unpleasant significance to all concerned with electric tramways.

The aggregate of casualties is much greater than we care to recall, and we cannot doubt that the confidence of the patrons of tramways throughout Great Britain, even perhaps throughout the whole world, has been shaken to such purpose that the effects of the shock will be seen in the receipts of many concerns.

That accidents of a particular description repeat themselves in a kind of epidemic is a coincidence which has been observed often, and it may be that the Highgate and Halifax accidents were caused in some high or low degree by an obscure psychological effect which the previous catastrophes had produced on the motormen concerned. However that may be, it is not that aspect which we propose to discuss here, but rather the more practical relation of brakes to runaways.

Tramcars run away for one of two reasons—first, the owners are negligent, and secondly, the driver is negligent.

The owner's negligence covers an inadequate provision of brakes, as well as keeping them in bad repair, while the driver's negligence includes incapacity, carelessness and fright.

We feel quite safe in saying that there is no electric car running to-day on which the braking equipment is not entirely adequate so long as it is kept in order, and so long as the car is driven properly. There is no car which has not at least two forms of brake, and few in which the electric brake is solely an emergency brake of extraordinary power, for most of them are graduated.

It is for individual owners to decide what brakes shall be fitted to their cars, and we may believe that, even without the necessity of satisfying an inspecting officer of the B. of T., they can be trusted to guard themselves from future accident as well as they are able. With the official inspection before them, there is no chance of their doing otherwise.

From time to time we have dealt in a broad way with the comparative excellence of the best-known brakes, and so recently as March 23rd, in reviewing Mr. Fell's paper on brakes, we gave expression to the following views:—"We incline to believe that nothing but the electro-magnetic brake will supersede the present forms of hand brake on electric tramcars, unless some really economical and compact stored air system is developed. Even then the magnetic brake will take much ousting."

That was written in full knowledge of the extent to which air brakes of various kinds have been used on foreign and British tramcars; neither did we omit to mention that air brakes were not tested by Mr. Fell, and in spite of the bare fact that in several of the recent mishaps the cars were equipped with the very type of electric track and wheel brake which came triumphantly through those tests, we see no reason to retreat from our position, which ought not to be assumed to be one of dogmatic opposition to air-brakes now and for ever. The passage quoted above should have been enough to prevent that idea from germinating.

In our issue of December 2nd, 1904, in noticing an article in a contemporary, we said: "When heavy grades have to be negotiated, a power brake of some kind should be used; Mr. Sheffield thinks that for this work the wheel-brake, however actuated, must give way to the track brake, and that is a judgment with which we concur. Remove the wheel-brakes altogether or keep them as a stand-by, or to hold the car on a hill, and rely solely on the slipper." Now, as then, we urge reliance on one brake only for ordinary service, and recommend a track brake operated by some thing other than human force transmitted through levers and rods, but above all let it not be in the power of the motorman to neutralise the effect of any brakes that he has. One of the strongest arguments for the air track brake is that its action is not affected by anything done to the other brakes, and we have no more thought of denying this attribute than we have of belittling its manifold other good points, but we express the opinion of the majority when saying that for general handiness, for efficiency, and for reliability, the magnetic track brake is ahead even of the former. The manufacturers of the simpler form of magnetic brake suggest that the recent accidents demonstrated in a negative way the superiority of their product, and the firm who supply the best known of the air track brakes do not hesitate to say that those accidents would not have occurred if their brake had been fitted to the cars.

Until Mr. Fell's tests were published we preferred the simple track shoes, but in the light of those tests we could not but say that the interdependent wheel and track shoes had assumed the premier position, from which they could be dislodged only by proof of considerable practical advantages on behalf of the other. We leave to our readers the invidious task of deciding whether the Highgate and Swindon accidents have supplied the requisite evidence, although we must point out that it can be nothing more than presumptive under the circumstances.

Then, as to the claim of the air brake makers, we are prepared to accept their statement, and we wish heartily, for the sake of all concerned, that these unfortunate cars had been equipped with air track-brakes; but that does not alter our opinion that it is not only desirable but also possible to equip cars with electro-magnetic track brakes in such a

manner that a driver cannot fail, except as the result of gross negligence on the part of the shed staff, to stop his car as certainly as with the air brake, and more certainly than with any other form. The first essential to this end is to prevent the driver from trying to ring the changes on two or three different kinds of mutually destructive brakes. The man who drives recklessly, and allows his car to run into danger, is just the man to lose his head in an emergency, and if he is given the opportunity he will lock the wheels and then do vain things with the controller handle, the reversing lever and the canopy switch, trying the electric brake, trying the "trick emergency" brake, "giving her back juice," *i.e.*, reversing the motor connections, and "giving her forward juice to unlock the wheels," until the smash comes.

The brake that is to save the car in an emergency ought to be the one that is used in service, and "emergency drill" should take a prominent place in the schooling of motormen.

We have insisted constantly on the very vital necessity for educating motormen, and we note that the jury in the Highgate inquest gave it as their opinion that the driver was insufficiently trained, and on that account caused the brakes to be inoperative just when they were wanted most. The driver is in the prime of life, and had been passed out of a well-equipped motormen's school three weeks before the accident. In the opinion of the certifying instructor, he was a competent man. It appeared in evidence that special instructions were given to all motormen running on this hill about the use of the magnetic brake, which was to be put on from the brow. The driver seems to have overlooked this order and to have begun the descent on the hand-brake. When the wheels began to skid, he appears to have lost his head to such a degree that when he jumped off the car before the final crash came the wheels were free and no brake was on. A study of the evidence gives the impression that at some time during the descent the conductor tried to help the driver by putting on the hand-brake from the rear platform—a thing that seems to have occurred at Swindon, too. That is a perilous proceeding, and should be forbidden absolutely unless the driver is incapacitated or leaves his position.

There is nothing whatever in the Highgate accident to show that the company neglected its duty to the public either by employing untrained drivers or by allowing the brakes to become defective, and there is every reason to think that the brakes were entirely adequate to stop the car even when it had run away, if only the driver had kept his senses sufficiently to remember his training. Admittedly the rails were greasy, but the driver was anxious to explain that that was their normal condition, not recognising that the fact went against him as showing that he ought to have had no difficulty in dealing with them after his experience. Except for greasy rails, there would be few runaways, and we have always thought it strange that tramway proprietors have not thought it worth while to keep the rails on long or steep hills free from grease. By doing so they would remove a great nervous stress from the motormen, decrease the car-miles lost in greasy weather, reduce the bill for energy, and insure themselves cheaply against accidents. In many towns where gradients are especially severe, there ought to be no choice in the matter.

In justice to the air track brake, we ought to say that it will remain in action after a car has left the rails, whereas a magnetic brake cannot do so. We do not attach a great deal of value to this feature, but we want to be fair to everyone.

While it is evident from the Highgate accident that training does not necessarily render a motorman immune from disastrous mistakes, no one will be foolish enough to suggest that it is useless. The more intimately a motorman knows his car, knows every part of its equipment and its functions, the less chance there is of his doing something wrong with the handles when his time comes; and the only way in which this knowledge can be got is by training in the class-room and on the car, supplemented by the men's own efforts to learn by private reading. To them such a handbook as Agnew's, reviewed some time ago in these columns and now in its third edition, is invaluable, for, in the smallest possible space commensurate with clearness both of type and matter, the whole subject is there presented in a manner which cannot fail to illuminate the mind of the dullest motorman.

Handbooks such as this should form part of the kit for which motormen sign when they start regular work, and periodical examinations upon its contents should be held by the management.

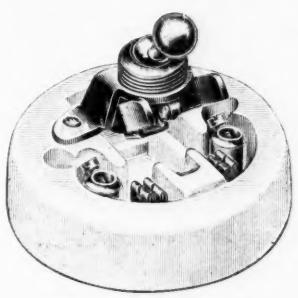
NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Armoured Casing.

Mr. Louis Howell, of 10, Victoria Road, Swindon, is introducing a new armoured casing which consists of ordinary wood casing having metallic covering, which is claimed to render it fireproof and to make it applicable for concealed work. A lower metal channel is secured to the wall by screws at the back, the wood casing being placed in it and held in position by means of binding strips, which are turned edgeways, binding against the casing and the top inner edge of the channeling. As the wires are run in their respective grooves they are kept in position by the replacement of the binding strips. It is claimed that the whole of the wiring may be compl ted in this manner, and that it is open to inspection and remains so until the capping is placed in position; as this proceeds the binding strips are turned flat across the capping, in this case again wedging beneath the inner top edge of the channel. By this binding strip arrangement screws for holding the casing in the channeling and capping screws are dispensed with; the strips also hold the wires temporarily in the grooves during erection. The top metal cover is easily sprung into position. Bends, tees, angles, &c., may be made similar to ordinary fittings, but of such section as to clip over the metal channel and cover when put together.

New Tumbler Switch.

The Wandsworth Electrical Manufacturing Co., Ltd., of 9, St. Paul's Square, Birmingham, have placed upon the market a patent tumbler switch which presents two or three unique advantages, the most important being the double contact. It is claimed to be practically impossible for the switch not to make good contact. The length of break is about 1 in., which is considerably more than that of the ordinary 5-amp. tumbler. The action is



New Tumbler Switch.

sweet, the insulation of best ebonite, and the workmanship of high quality. A special feature of this company's switches is that they are so designed that moving parts do not work upon the insulation. They have made a speciality of this class of work and have excellent plant to deal with it. We understand that several large contracts have already been placed for these switches.

Registration of Trade Marks in China.—Messrs. W. P. Thompson & Co., patent agents, Liverpool, write to us regarding a statement which recently appeared in the Press to the effect that the Shangpoo intended to open the Chinese Bureau for the registration of trade marks on the first day of the fifth moon—namely, June 22nd of this year. As a result of inquiries made by their agents, Messrs. Thompson state that it is extremely uncertain when either the patent or the trade mark bureau will be open in China, as the Chinese Government are still very conservative. It is expected, however, that the Trade Marks Office will be opened prior to the Patent Office, and some time this year, and a large number of applications for trade marks by English firms have already been g the formal opening of the office.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

14,972A/1905. "Improvements in and relating to the manufacture of incandescent electric lamp filaments from thorium and like metals." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) (Date applied for under Rule 5 of the Patents Rules, 1905, July 20th, 1905.) July 6th.

14,971. "Improvements relating to insulating materials." W. KENNEDY-LAURIE DICKSON. July 2nd.

15,007. "Improvements in or relating to the suspension of arc lamps or the like." C. A. SCHAEFER. (Date applied for under Patents Act, 1901, November 28th, 1905, being date of application in Germany.) July 2nd. (Complete.)

15,016. "Improvements in and connected with point shifting arrangements for electric tramways and the like." J. P. TIERNEY and J. MALONE. July 2nd. (Complete.)

15,021. "Incandescence bodies composed of tungsten for incandescent lamps." CONSORTIUM FUR ELEKTROCHEMISCHE INDUSTRIE G.m.b.H. (Date applied for under Patents Act, 1901, July 5th, 1905, being date of application in Germany.) July 2nd. (Complete.)

15,022. "Improved electrical winding apparatus for clocks and the like. SCHNEIDER & WESENFELD G.m.b.H. (Date applied for under Patents Act, 1901, March 7th, 1906, being date of application in Germany.) July 2nd. (Complete.)

15,033. "Improvements in apparatus for automatically regulating the currents of electric circuits." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 2nd. (Complete.)

15,034. "Improvements in apparatus for varying electromotive force in finely divided steps in three-wire electrical installations." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 2nd. (Complete.)

15,035. "Improvements in apparatus for automatically regulating several parallel connected electrical generators." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 2nd. (Complete.)

15,052. "Improvements in or relating to magnets for arc lamps." W. MATHIESEN. July 2nd. (Complete.)

15,053. "Improvements relating to electrical apparatus for protection against insects." A. L. M. CHAULIN. (Date applied for under Patents Act, 1901, July 18th, 1905, being date of application in France.) July 2nd. Complete.)

15,060. "Improvements in electric meters." E. SCHATTNER. July 2nd.

15,099. "Improvements in the construction of an electric power driven brush for cleaning purposes." J. WORTHINGTON. July 3rd.

15,100. "Automatic slipper applicable to electric tramcars." J. C. BERRY. July 3rd.

15,104. "Improvements in multiple unit control systems." H. McL. HARDING and C. M. CLARK. (Date applied for under Patents Act, 1901, January 6th, 1906, being date of application in United States.) July 3rd. Complete.)

15,017. "Improvements in three-phase arc lamps." J. W. NASMITH. (T. L. Carbone, Germany.) July 3rd. (Complete.)

15,134. "Improvement in the brakes of electric trams and the like." D. J. MORGAN. July 3rd.

15,135. "Improvements in and relating to dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 3rd.

15,161. "Improvements in electric relays." K. CASKA. July 3rd.

15,178. "Improvements relating to the electrical connections of motor road vehicles having electro-mechanical propulsion." H. PIEPER. July 4th. (Complete.)

15,195. "Improvements relating to stands for use in connection with telephones." L. R. S. C. BLAKE. July 4th.

15,196. "Improvements in or relating to electric arc lamps." E. CERVENKA. July 4th.

15,200. "Improvements in cells of electric storage batteries and other electric batteries." A. E. Segnitz. July 4th.

15,222. "Improvements in and relating to dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 4th.

15,223. "Improvements in and relating to systems of electric motor control." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 4th.

15,230. "Improvements in electric heating devices." J. C. TOURNIER. Date applied for under Patents Act, 1901, September 25th, 1905, being date of application in United States.) July 4th. (Complete.)

15,231. "Improved method and means for driving machines electrically." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schucktwerke G.m.b.H., Germany.) July 4th. (Complete.)

15,237. "Improvements relating to separators for secondary battery plates." H. H. LAKE. (The Rhode Island Electromobile Co., United States.) July 4th. Complete.)

15,245. "Electro-thermo detector." R. W. ROBSON and G. W. CLEGG. July 5th.

15,259. "Improvements in electrical apparatus for transmitting and receiving signals." A. BARR, W. STROUD and H. D. JACKSON. July 5th.

15,277. "Mechanism for the adjustment of the moment of ignition in gas engines." E. CAPITAINE. (Date applied for under Patents Act, 1901, July 6th, 1905, being date of application in Germany.) July 5th. (Complete.)

15,281. "Improvements in and relating to controllers for variable speed motors." A. G. BROOKES. (Cushman Electric Co., U.S.) July 5th. (Complete.)

15,288. "Improvements in apparatus for controlling and operating the points of electric railways and tramways." W. H. TURNER. July 5th.

15,310. "Improvements in or relating to electric arc lamps." C. OLIVER. July 5th.

15,313. "Improvements in automatic electric brakes." J. H. K. MCCOLLUM. July 5th.

15,316. "Improvements in and relating to solenoid operated electric switches." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co.) July 5th.

15,351. "Improvements in electro-galvanic appliances for rheumatism and the like complaints." E. V. GRATZE. July 6th.

15,400. "Improvements in the trolley pulleys of overhead wire electric tramways." W. H. LOWE. July 6th. (Complete.)

15,412. "Improvements in or relating to the ignition of internal combustion engines." M. KEMP-WELCH and P. LYLE. July 6th.

15,413. Non-slipping safety electric car brake and road-gripping block. A. J. REYNOLDS. July 6th.

15,428. "Improvements in electric switches." W. F. JONES. July 7th.

15,447. Conduit brake for tramways and railways." T. BENFIELD. July 7th.

Devon and Cornwall.—The Inspector of Factories and Workshops for Devon and Cornwall points out in his annual report that the most notable industrial development in his division is the continued increase in electrically-driven machinery.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

ELECTRIC IGNITING APPARATUS FOR MULTIPLE CYLINDER INTERNAL COMBUSTION ENGINES. F. H. Royce. 23,556. November 16th.

IGNITION PLUGS FOR INTERNAL COMBUSTION ENGINES. A. Daveluy. 24,642. November 28th. (Date applied for under International Convention, December 5th, 1904.)

ELECTRODES FOR PULSATING CURRENT VAPOUR ELECTRIC APPARATUS. C. O. Bastian and G. Calvert. 4,867. March 8th.

ELECTROPLATING OF METALS. J. Schiele. 10,120. May 13th.

ELECTRIC ACCUMULATOR PLATES FOR THE STORAGE OF ELECTRICITY. F. T. Kelley. 12,253. June 13th.

GALVANIC BATTERIES. B. J. Blameuser, E. C. Blameuser, N. Kribs and W. J. Bauerle. 12,315. June 13th.

PREPAYMENT MECHANISM FOR ELECTRIC METERS. British Thomson-Houston Co. and W. J. Lloyd and K. F. Kingwell. 12,507. June 16th.

TELEPHONE APPARATUS FOR USE FOR DIVING AND LIKE PURPOSES. A. Graham and R. H. Davis. 12,682. June 19th.

DYNAMO-ELECTRIC MACHINES. Allgemeine Elektricitats Ges. 12,792. June 20th. (Date applied for under International Convention, September 17th, 1904.)

INSULATION OF ELECTRIC CONDUCTORS. British Thomson-Houston Co. (General Electric Co.) 15,770. August 1st.

ALTERNATING CURRENT ELECTRIC MOTORS. British Thomson-Houston Co. (General Electric Co.) 16,303. August 10th.

ELECTRIC SWITCHES. K. Schmahl. 16,373. August 11th.

INSULATING MATERIAL. British Thomson-Houston Co. (General Electric Co.) 19,035. September 20th.

MULTI-RATE ELECTRIC MEASURING APPARATUS. British Thomson-Houston Co. (General Electric Co.) 19,036. September 20th.

TROLLEY HEADS EMPLOYED UPON ELECTRICALLY PROPELLED VEHICLES. M. P. McLaren. 22,578. November 4th.

SYSTEMS OF CONNECTIONS FOR TELEPHONE OFFICES WITH SEPARATED PLUG-SERVICE AND GROUP-CALLING. Deutsche Telephonwerke R. Stock & Co. 23,085. November 10th. (Date applied for under International Convention, November 10th, 1904.)

MAGNETO-ELECTRIC GENERATORS. L. A. Gianoli. 24,621. November 28th. (Date applied for under International Convention, December 2nd, 1904.)

NERNST LAMPS. Allgemeine Elektricitats Ges. 25,236. December 5th. (Date applied for under International Convention, December 5th, 1904.)

CONTACT BREAKERS AND IGNITION DEVICES FOR EXPLOSION ENGINES. R. Munro. 25,600. December 8th. (Date applied for under International Convention, December 8th, 1904.)

SYSTEMS OF CONNECTIONS FOR THE OPERATION OF BRANCH TELEPHONE STATIONS AND THE LIKE. W. Ohnesorge. 26,348. December 18th. (Date applied for under International Convention, December 17th, 1904.)

CONNECTIONS FOR TWO OR MORE THREE-PHASE ELECTRIC MOTORS. C. de Kando. 26,629. December 20th.

SINGLE-PHASE COMMUTATOR MOTORS. V. A. Fynn. 26,897. December 23rd. (Date applied for under International Convention, March 25th, 1905.)

1903.

ALTERNATING CURRENT VAPOUR ELECTRIC APPARATUS. P. H. Thomas. 707. January 10th. (Date applied for under International Convention, January 27th, 1905.)

TELEPHONE SYSTEM. E. K. Hall. 2,452. January 31st. (Date applied for under International Convention, February 8th, 1905.)

ELECTRICAL MUSCULAR EXERCISING MACHINES. R. O. Hammond. 3,430. February 12th. (Date applied for under International Convention, May 23rd, 1905.)

ELECTRIC CIRCUIT BREAKERS. S. B. Stewart. 6,614. March 19th. (Date applied for under International Convention, March 20th, 1905.)

CONTROLLING SYSTEMS FOR ELECTRIC MOTORS. W. Cooper. 8,402. April 7th. (Date applied for under International Convention, April 10th, 1905.)

DYNAMO-ELECTRICAL MACHINES. Elektricitats Akt.-Ges. vorm W. Lahmeyer and Co. 8,526. April 9th. (Date applied for under International Convention, April 11th, 1905.)

ELECTRO-MAGNETIC AUTOMATIC INTERRUPTER. Siemens Bros. & Co. (Siemens and Halske, Akt.-Ges.) 11,181. May 12th.

Municipal Ownership in Canada.—A correspondent at Ottawa writes:—"The extent to which the question of municipal ownership of electrical power franchises has permeated the Canadian Municipalities is shown by the recent action of the City of Winnipeg on June 28th, in voting, three to one, for the construction of a municipal power plant on the Winnipeg River at a cost of $3,250,000, with an annual interest charge of $130,000, and sinking fund of $38,000, or a total charge of $168,000 per annum. This vote is the more striking, in the face of the great enterprise, completed only a few weeks ago, of the Street Railway Co., by which, at an expenditure of $3.000,000, they have brought in power some 60 miles from the Winnipeg River, and guaranteed a reduction of 50 to 70 per cent. from former charges. Though the company has already made reductions from 12 and 12½ cents per unit for power for elevators and motors to 6 and 4 cents respectively, and for lighting from 20 to 10 cents, with a promise of further reductions when the plant is working properly, yet, apparently, the city will put no confidence in private enterprises, but is determined to furnish the power itself. This large vote is also more striking when we consider that the debt of the city is already over 11 millions, and this recent vote will bring the city's debt to $16,000,000. For a population of 101,000, this is a very large debt. Yet Winnipeg hopes for a rapidly increased population, and that the providing of power at low cost will induce manufacturers of all kinds to locate in the city.".